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CHEMISTRY.—*The occurrence of the methoxyl, ethoxyl and methylene dioxide groups in substances of vegetable origin and a possible explanation of the mechanism for their formation by the plant.*[1]

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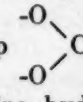
The alkoxyl group, particularly the methoxyl group $-OCH_3$, is found widely distributed in substances of vegetable origin. Alkoxyl groups containing a greater number of carbon atoms than that found in the ethoxyl group $-O \cdot CH_2 \cdot CH_3$ rarely occur in substances of plant origin, and even the ethoxyl group has been found infrequently in such materials. The divalent methylene dioxide group  although it is found in certain alkaloids, such as piperine, hydrastine, berberine, narcotine, and narceine, and in certain constituents of essential oils, such as in piperonal, safrol, myristicin, apiol, and dillapiol, cannot, however, be compared with the methoxyl group in its frequency of occurrence and in its wide distribution in the vegetable kingdom.

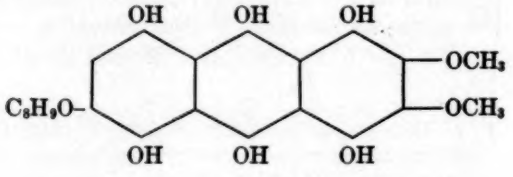
The methoxyl group may be considered as derived from a phenolic or alcoholic hydroxyl group in which the hydrogen has been replaced by a methyl group. The substance thus formed is a methyl ether. When acidic hydroxyl groups are thus substituted methyl esters are formed. It is of interest to point out in this connection that the methoxyl group does not occur in substances synthesized by the animal body.

It appears that the synthesis of the methoxyl group can be brought about by all plants from the very lowest to the very highest in evolutionary development. Thus prodigiosin, the red coloring substance produced by *Bacillus prodigiosus*, was found by Wrede and Rothhaas (19) to contain one methoxyl group. As we examine the higher

[1] Received June 3, 1935.

forms of plant life among the Thallophytes we find that the moulds, are capable of synthesizing compounds containing the methoxyl group. Thus Birkinshaw and Raistrick (1) isolated a methoxy dihydroxy toluquinone from a glucose solution on which a species of *Penicillium* belonging to the *P. spinulosum* series had grown.

Numerous compounds containing the methoxyl group have been isolated from lichens. Thus solorinic acid isolated by Zopf (20) from *Solorina crocea* was shown to contain one methoxyl group. According to Hesse (6), solorinic acid contains two methoxyl groups and is represented by this formula:



Sordinin isolated by Paterno and Crosa (10) from *Lecanora sulphurea* was found to contain one methoxyl group. Evernic acid which occurs in *Evernia prunastri* and in *Ramalina pollinaria* and chrysocetraric acid which has been isolated from *Cetraria pianastri* were both found to contain methoxyl groups (5).

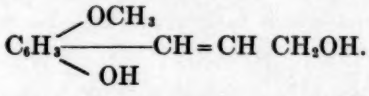
With reference to the occurrence of the methoxyl group in substances synthesized by Bryophytes, mention may be made, of the work of Fischer, Schrader and Friedrich (3), who found that *Sphagnum medium* contained 0.32 per cent methoxyl, and that the coarser fibers of *Sphagnum cuspidatum* contained 0.39 per cent methoxyl. The fraction of *S. medium* which was insoluble in fuming hydrochloric acid contained 1.33 per cent methoxyl.

The occurrence of methoxyl-containing substances among the Pteridophytes has been definitely established. Linsbauer (8) has shown that plants belonging to this group, unlike Thallophytes and Bryophytes, contain lignin in their cell structure. It has been definitely shown that lignin contains methoxyl groups (12).

Among the Spermatophytes, substances containing the methoxyl group are so numerous and so widely distributed that it would be difficult indeed to find any plant whose constituents do not contain this group. Lignin which is a constituent of the woody (lignified) portions of higher plants, such as stalks, stems, cobs, hulls, leaves, trunks of trees and shrubs, contains methoxyl groups.

Whatever the physiological significance of the methoxyl group may be, it must be borne in mind that it is found in substances that may occur in almost any organ of a plant, from the root to the flower, and in plants very remote phyletically from one another. No attempt will be made here to list all the many substances isolated from Spermatophytes and known to contain the methoxyl group. Mention will be made of only a few such substances selected from a variety of families and also from different organs of the plant. The purpose of this presentation is merely to indicate the rather common occurrence of the methoxyl group in substances of plant origin.

The glucoside coniferine occurs in the cambium of coniferous woods and also in the black root of *Scorzonera hispanica* (9). This compound when hydrolyzed yields glucose and coniferyl alcohol (16),



Vanillin, which is the methyl ether of protocatechuic aldehyde, occurs widely distributed in the vegetable kingdon, but more especially in the fruit of *Vanilla planifolia*, a plant which is a native of the forested valleys of the eastern Mexican Andes, but is now cultivated in nearly all tropical countries.

Among the phenol ethers which have been found in many flowering plants mention may be made of the following: Methylchavicol, anethol, dimethyl ether of thymohydroquinone, eugenol, methyleugenol, isoeugenol, methylisoeugenol, asarone, apiol, dillapiol, and myristicin. These compounds have been isolated from plants belonging to the following families (14): Aristolochiaceae, Annonaceae, Myristicaceae, Lauraceae, Rosaceae, Myrtaceae, Umbelliferae, and Labiatae.

Among the class of plant alkaloids, numerous representatives containing the methoxyl group are found (4). Only a few need be mentioned in this connection, namely, berberine, papaverine, laudanosine, quinine, brucine, anhalamine, mezcaline, anhalonine, lophophorine, hydrastine, dehydrocorydaline, bulbocapnine, corytuberine, glaucine, codeine, and narcotine. The alkaloids have been found in the following natural orders of plants: Ranunculaceae, Rubiaceae, Papaveraceae, Fumariceae, Solanaceae, Leguminosae, Apocynaceae, and Compositae.

Many of the plant pigments and coloring substances contain methoxyl groups. Mention may be made of gentisin (7), which is the coloring substance of gentian roots; curcumin (2), a constituent of

several species of *Curcuma*, acacetin (11), the coloring matter of the leaves of *Robinia pseudacacia* (L.); peonidin (17), which occurs in the form of its diglucoside (peonin) in the flower of the deep violet-red peony; oenidin (18), the product of hydrolysis of oenin pigment of the black grape; and myrtillin (18), (a monoglucoside of myrtillidin), the pigment of the fruit of the bilberry (*Vaccinium myrtillus*).

SPECULATIONS CONCERNING PHYTOCHEMICAL SYNTHESIS OF METHOXYL, ETHOXYL, AND METHYLENE DIOXIDE GROUPS

Pictet (13), in a paper dealing with the genesis of the alkaloids in plants, suggests that the methoxyl group, which is met rather frequently in this class of organic compounds, and the methylene dioxide group are formed by the plant from formaldehyde. According to Pictet, the reactions which take place may be represented by the following equations:

$$ROH + CH_2O = ROCH_3 + O$$

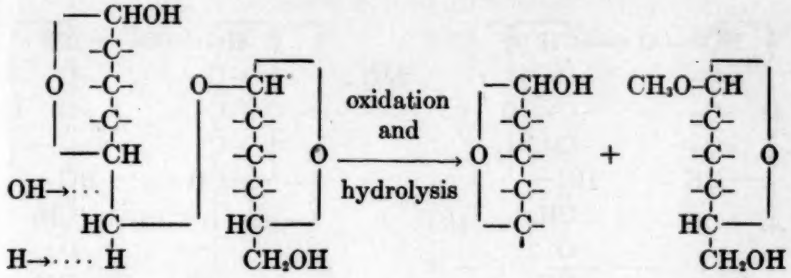
$$R\begin{matrix}OH\\OH\end{matrix} + CH_2O = R\begin{matrix}O\\O\end{matrix}CH_2 + H_2O.$$

Robinson (15), in connection with his theory of the mechanism of the phytochemical synthesis of certain alkaloids, has adopted Pictet's conception of the formation of the methoxyl and methylene dioxide groups by the plant.

While the formaldehyde hypothesis of Pictet might explain the formation of the methoxyl group in substances synthesized by higher plants, it obviously cannot account for its presence in compounds produced by certain Thallophytes, as, for example, the fungi. Thus, for example, it canot account for the formation of methoxyl dihydroxy toluquinone by a species of *Penicillium* which grew on a solution containing *pure glucose* as its sole source of carbon. (1).

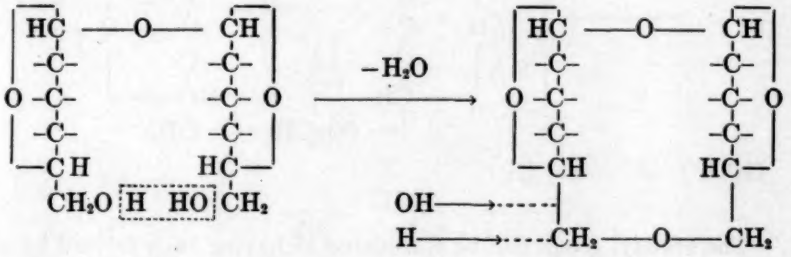
The writers wish to offer the following suggestion as a possible explanation of the mechanism involved in the formation by the plant of the methoxyl, ethoxyl, and methylene dioxide groups: These groups, it is believed, are not synthesized by the plant directly from formaldehyde by a process of methylation or methylenation, but are formed in the course of splitting up of carbohydrates by a process of hydrolysis, oxidation, reduction, and dehydration. The reactions which take place may be illustrated as follows:

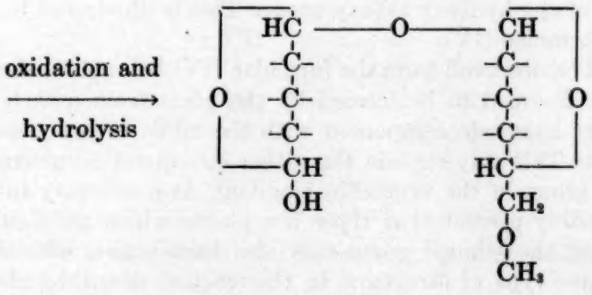
FORMATION OF METHOXYL GROUP



I

or

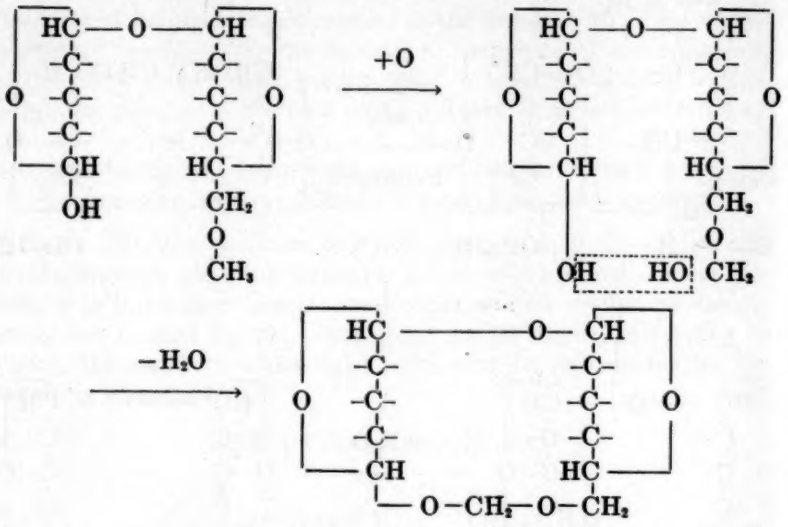




II

The methylene dioxide group can be considered as having been formed by a process of hydroxylation of the methyoxyl group, and the subsequent condensation with another hydroxyl group is illustrated below (III).

FORMATION OF METHYLENE DIOXIDE GROUP

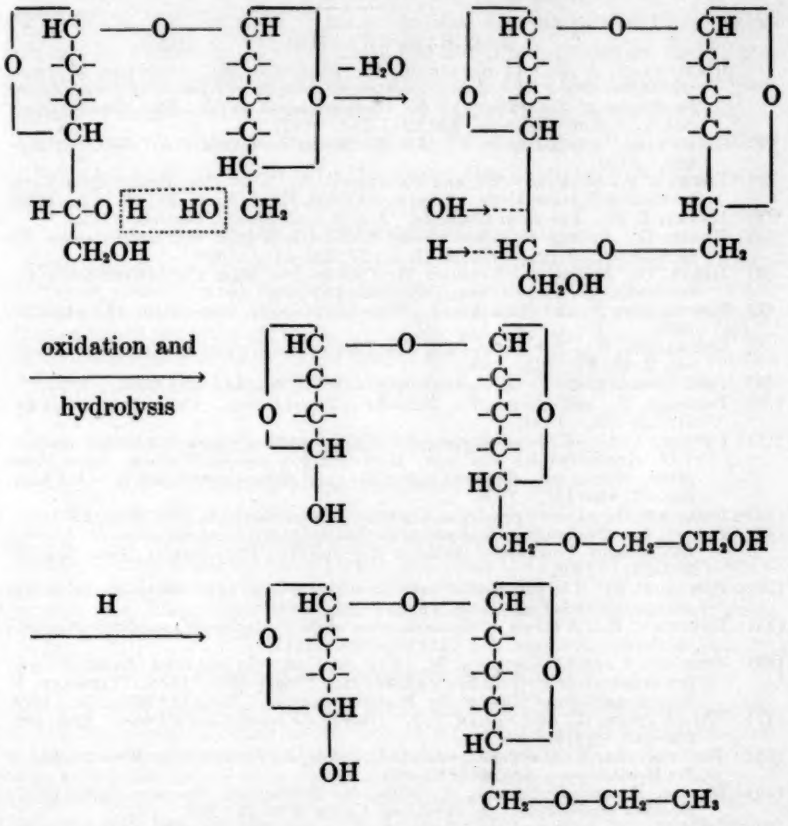


III

The ethoxyl group can be considered as having been formed by a process of splitting a carbohydrate linkage and the subsequent reduction of the hydroxy ethoxy group. This is illustrated by the following formulae (IV).

It will be observed from the formulae (IV) below that the ethoxyl group is assumed to be formed by the plant from a carbohydrate having at least one component with the labile or furanose type of structure. This may explain the rather infrequent occurrence of the ethoxyl group in the vegetable kingdom. As a corollary to this, we may possibly predict that those few plants which yield substances containing the ethoxyl group may also have sugars with the labile or furanose type of structure. In the reaction described above it is conceivable that the reduction of the $-CH_2OH$ group to a methyl group may precede oxidation and hydrolysis. This probably takes place when the plant produces methyl pentoses from hexose sugars. It is our belief that the methoxyl, ethoxyl, and methylene dioxide groups in the naturally occurring organic substances represent the original carbohydrate linkages. The presence of the methoxyl group in substances synthesized by fungi from pure sugar is readily ex-

FORMATION OF ETHOXYL GROUP



IV

plained on the assumption that the reaction proceeds as illustrated above (I and II).

Lignin, which is the most abundant methoxyl-containing constituent of higher plants, is synthesized by the plant from carbohydrates, and it is conceivable that lignin or possibly primitive lignin ("ur" lignin) may in turn be the parent substance of many of the methoxyl-containing constituents of higher plants. This is, of course, purely speculative, but it is our belief that the future development of plant chemistry will be more and more along the lines of determining from

what parent materials and in what manner the different organic chemical substances of plants are derived.

LITERATURE CITED

(1) BIRKINSHAW, J. H., and RAISTRICK, H. *Studies in the biochemistry of micro-organisms. On a new methoxy-dihydroxy-toluquinone produced from glucose by species of* Penicillium *of the* P. spinulosum *series.* Phil. Trans. Roy. Soc. (London), Series B, **220**: 245–254. 1931.

(2) CIAMICIAN, G., and SILBER, P. *Zur Kenntniss des Curcumins.* Ber. **30**: 192–195. 1897.

(3) FISCHER, F., SCHRADER, H., and FRIEDRICH, A. *Über den Methoxylgehalt vermodernder Pflanzenstoffe.* Gesam. Abhand. Kenn. Kohle **5**: 530–542. 1922.

(4) HENRY, T. H. *The plant alkaloids.* J. and A. Churchill, London. 1924.

(5) HESSE, O. *Beitrag zur Kenntnis der Flechten und ihrer charakteristischen Bestandtheile.* J. prakt. Chem. (N.F.) **57**: 232–318. 1898.

(6) HESSE, O. *Beitrag zur Kenntnis der Flechten und ihrer charakteristischen Bestandteile.* J. prakt. Chem. (N.F.) **92**: 425–466. 1915.

(7) KOSTANECKI, S., and SCHMIDT, E. *Über das Gentisin.* Monatsh. **12**: 318–325. 1891.

(8) LINSBAUER, K. *Zur Verbreitung des Lignins bei Gefässkryptogamen.* Osterr. bot. Z. **49**: 317–323. 1899.

(9) VON LIPPMANN, E. O. *Kleinere Mittheilungen.* Ber. **25**: 3216–3221. 1892.

(10) PALERNO, E., and CROSA, F. *Ricerche sulla sordidina.* Gazz. chim. ital. **24**: II, 325–335. 1894.

(11) PERKIN, A. G. *Yellow colouring principles contained in various tannin matters. VII. Arctostaphylos uva ursi, Haematoxylon campeachianum, Rhus metopium, Myrica gale, Coriaria myrtifolia, and Robinia pseudacacia.* J. Chem. Soc. **77**: 423–432. 1900.

(12) PHILLIPS, M. *The Chemistry of Lignin.* Chem. Rev. **14**: 103–170. 1934.

(13) PICTET, A. *Quelques Considérations sur la Genèse des Alcaloides dans les Plantes. Bibliotheque Universelle Archives des Sciences Physiques et Naturelles* **19**: 329–352. 1905.

(14) POWER, F. B. *The distribution and characters of some of the odorous principles of plants.* J. Ind. Eng. Chem. **11**: 344–352. 1919.

(15) ROBINSON, R. *A theory of the mechanism of the phytochemical synthesis of certain alkaloids.* J. Chem. Soc. **111**: 876–899. 1917.

(16) TIEMANN, F., and HAARMANN, W. *Über das Coniferin und seine Umwandlung in das aromatische Princip der Vanille.* Ber. **7**: 608–623. 1874. TIEMANN, F. *Zur Kenntnis der Glieder der Protocatechureihe.* Ber. **11**: 659–675. 1878.

(17) WILLSTATTER, R., and NOLAN, T. J. *Über den Farbstoff der Päonie.* Ann. **408**: 136–146. 1915.

(18) WILLSTATTER, R., and ZOLLINGER, E. H. *Über die Farbstoffe der Weintraube und der Heidelbeere.* Ann. **408**: 83–109. 1915.

(19) WREDE, F., and ROTHHAAS, A. *Über das Prodigiosin, den roten Farbstoff des Bacillus prodigiosus.* Z. physiolog. Chem. **219**: 267–274. 1933.

(20) ZOPF, W. *Zur Kenntniss der Flechtenstoffe.* Ann. **284**: 107–132. 1895.

STRATIGRAPHY.—*New formation names in the Michigan Devonian.*[1]

A. S. WARTHIN, JR., Vassar College, and G. ARTHUR COOPER, U. S. National Museum. (Communicated by ROLAND W. BROWN.)

The Traverse group of Michigan has long been known for its abundance of fine fossils, but the detailed study of these fossils has been hampered by ignorance of the stratigraphy involved. The authors, in the course of studies on the correlation of the middle

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Devonian of the interior states, have developed a fairly complete and usable subdivision of the Traverse rocks exposed in the Thunder Bay region. As the final description and correlation of these rocks will not be available for some time the authors here define the formational units recognized in order to facilitate the descriptive paleontological work now being conducted by other students in the area.

The new formations here recognized are arranged in descending order, and their division into the three stages already known is indicated.

Squaw Bay limestone, new name[2]

Brown limestone, dolomitic in some beds, containing *Styliolina* and upper Devonian goniatites. It lies below the Antrim black shale, and above the Partridge Point formation. Thickness exposed, three feet; nearby wells indicate a probable total of twelve feet. Type locality, the Squaw Bay shoreline of Partridge Point, center S. line of sec. 11, T. 30 N., R. 8 E., Alpena County, Michigan. This formation probably should be excluded from the Traverse group.

THUNDER BAY STAGE, Grabau ('02, p. 192)[3]

Partridge Point formation, new name

Gray and bluish argillaceous limestones, and gray calcareous shales, containing many crinoids and blastoids. Separated from the Squaw Bay limestone by a three foot covered interval, and from the Potter Farm formation below by an interval of not more than seventy feet. Thickness exposed, fourteen feet. Type locality, eastern shore of Partridge Point, three miles south of Alpena, Michigan.

Potter Farm formation, new name

Blue to gray shales, alternating with crinoidal, sublithographic or argillaceous limestones of small lateral extent, containing a fauna characterized by the common presence of *Cylindrophyllum*. Separated from the Partridge Point formation above by a covered interval of not over seventy feet, and lies directly on the upper clay of the Norway Point formation. Greatest thickness measured, thirty-six feet. Type locality, the Fred Potter farm, E. half of secs. 18 and 19, and sec. 20, T. 31 N., R. 8 E., Alpena County, Michigan.

Norway Point formation, new name

Brown and gray limestones, grading upward into argillaceous limestones and calcareous clay. Several of the beds carry *Spirifer* cf. *granulosus* and *Cryphaeus boothi*. Overlain directly by the Potter Farm formation, and underlain (sometimes with slight hiatus) by the Alpena limestone. Greatest thickness measured, forty-six feet. Type locality, Norway Point dam (also known as Boom Company or Seven-mile dam), Thunder Bay River, Alpena County, Michigan.

[2] New names in this paper have been checked and found available by Miss Grace Wilmarth, U. S. Geological Survey.

[3] Symbols after author's name refer to citations in the *Bibliography of North American Geology*, U. S. Geol. Surv., Bulls. 746, 1923, and 823, 1931.

ALPENA LIMESTONE STAGE, Grabau ('02, p. 175)

The authors recognize Ver Wiebe's ('10, p. 185) redefinition of the limits of the Alpena limestone, with the exception of the "black Alpena" zone which is separated below as the Killians limestone. The Dock Street clay of Grabau ('02, p. 192) is a local clay facies of the upper Alpena horizon.

LONG LAKE STAGE, Grabau ('02, p. 184)

Killians limestone, new name

Dark gray to black limestone with black shale layers. Overlain by gray and brown granular beds of Alpena limestone, and underlain by gray shales and limestones of the Genshaw formation. Greatest measured thickness, twenty-three feet. Type locality, exposures along French road, one-half mile south of the Killians resort, Long Lake, Alpena County, Michigan.

Genshaw formation, new name

Four persistent thin gray limestone beds, alternating with gray calcareous shales, all containing a large species of *Atrypa* and *Gypidula romingeri*. Overlain directly by black Killians beds, and underlain by clay shales of the Ferron Point formation. Measured thickness, fifty-one feet. Type locality, region around the Genshaw school, sec. 13, T. 32 N., R. 8 E., Alpena County, Michigan.

Ferron Point formation, new name

Green to bluish clays, interbedded with argillaceous limestones, all carrying an abundance of fossils. Overlain directly by the calcareous shale of the Genshaw formation and underlain by the Rockport limestone. Thickness, approximately thirty-five feet. Type locality, Rockport quarry, Rockport, Alpena County, Michigan.

ROCKPORT LIMESTONE, R. A. Smith ('16, p. 175)

BELL SHALE, Grabau ('02, p. 191)

Base of the Traverse group in Alpena region.

PALEONTOLOGY.—*Further notes on fossil larval chambers of mining bees.*[1] ROLAND W. BROWN, U. S. Geological Survey.

Since the publication of my first paper on this subject,[2] I have learned several important additional facts that merit statement and necessitate changes in the nomenclature applied to those fossils.

First, it was discovered that in 1907 some similar but more fragmentary fossils, lacking the spiral apices, were described by E. Schütze[3] as the fillings of bee chambers under the name *Anthophora*

[1] Published by permission of the Director, U. S. Geological Survey. Received July 24, 1935.

[2] BROWN, ROLAND W. Celliforma spirifer, *the fossil larval chambers of mining bees.* This JOURNAL 24: 532–539, text figs. 1–5. 1934.

[3] SCHÜTZE, E., in W. BRANCA and E. FRAAS. *Die Lagerungsverhältnisse Bunter Breccie an der Bahnlinie Donauwörth-Treuchtlingen und ihre Bedeutung für das Riesproblem.* K.-preuss. Akad. Wiss. Abh., Heft 2: 25–26, plate (opp. p. 56), figs. 22, 23. 1907.

Podalirius)? sp. Like Dall, Schütze observed a superficial resemblance of the fossils to fillings of pholad burrows but, unlike Dall, dismissed the pholad suggestion as unacceptable and referred the fossils to fillings of chambers made by an anthophorid bee. However, in this instance as with the Wyoming and Florida fossils also, because no remains of the insects themselves were found, and because it is not conclusively proved that the fossils are related to mining bees, although the circumstantial evidence points strongly in that direction, the reference to the particular genus *Anthophora*, it seems to me, is not an especially happy one.

Second, because differences between the specimens from Wyoming and those from Florida are discernible, as was pointed out in my first paper, it will clarify matters to distinguish two species. I therefore propose that the term *Celliforma* be the generic name to include all fossil fillings of chambers purporting to have been made originally by unknown mining Hymenoptera, and I designate *Celliforma spirifer* Brown, from the Bridger formation of Wyoming, as the genotype. The specimens from the "silex beds" of the Tampa limestone of Florida may be known as *Celliforma nuda* (Dall) Brown, new combination, and Schütze's specimens, from the Oligocene of Weilheim, Germany, as *Celliforma germanica* Brown, new name.

Third, several more new references to the literature on mining Hymenoptera indicate that other observers have also noted the spiral construction used by these bees in sealing their larval chambers. Friese[4] alludes to this structure in his discussion of *Anthophora*, and Rau,[5] discussing the carpenter bee (*Xylocopa virginica*), describes the nest construction and gives an excellent illustration of the spiral sawdust seal made by that species. The use of the spiral seal by *Emphor fuscojubatus* is illustrated in many newly-made chambers exhumed on July 18 and 21, 1935, Second and T Streets N. E., Washington, D.C. Incidental to the collection of these chambers, it was observed that, 1. This species of *Emphor* selects the site for a burrow, softens the hard soil with frequent applications of jets of water imbibed from the surface of the adjacent pool, and within 30 minutes constructs an entrance turret 1 centimeter high. 2. In less than 4 days she completes the burrow from 5 to 10 centimeters deep, fashions the larval chamber, fills it with the lemon-yellow pollen from the shrubby althea (*Hibiscus syriacus*), lays an elongated, pearly white

[4] FRIESE, A. *Beiträge zur Biologie der solitären Blumenwespen (Apidae)*. Zool. Jahrb. Abt. für System. Band 15: 818 ff. 1891.
[5] RAU, PHIL. *Jungle bees and wasps*, pp. 244–245, fig. 100. 1923.

egg *on the bottom* of the pollen mass, seals the chamber, packs the rest of the burrow with pellets derived from the turret, and closes the entrance with a smooth, saucer-shaped plug. 3. The pollen mass ferments, darkens somewhat and assumes a pasty consistency; and the larva, from the time of hatching, apparently occupies less than a week in consuming this stimulating nourishment and attaining its maximum length of about 1.5 centimeters.

Finally, the now accepted name *Melitoma* should be substituted for *Entechnia* in my former references to *Entechnia taurea*.

BOTANY.—*A new tree-fern from Trinidad.*[1] WILLIAM R. MAXON, National Museum.

The new species described herewith is one of the most interesting among the rich collections of Trinidad ferns received from the Venerable Archdeacon A. Hombersley in recent years. It is named with much pleasure in honor of its discoverer.

Hemitelia Hombersleyi Maxon, sp. nov.

Species *H. Wilsoni* affinis, sed tamen optime distinguenda, differt enim pinnis linearibus, pinnulis multo minoribus, obtusis (nec acuminato-attenuatis), et lobatis (nec pinnatifidis), lobis et serraturis parvis, venis paucis, paleis costae et venarum brunnescentibus nec albis, soris minimis, et indusiis pallide brunneis, nec albidis.

Rhizome an erect caudex about 60 cm. long and 5 cm. in diameter; scales tufted-imbricate, about 1.5 cm. long, 3 mm. broad at the lanceolate basal portion, attenuate-subulate, light brown, concolorous, the margins lightly erose-scarious. Fronds several, erect-arching, 1.5–2 m. long, the stipes short (30–40 cm. long), brown, slender, 1–1.5 cm. thick, freely beset with straight, narrowly conical, pungent spines 1–3 mm. long, paleaceous on inner face, the scales subovate, acuminate, 5–10 mm. long, mostly subfalcate, thin; blades about 1.5 m. long, 75 cm. broad at middle, broadly oblong, abruptly acuminate at apex, subbipinnate; pinnae about 18 pairs, opposite, slightly apart, linear, acuminate at apex, the two basal pairs short-stalked (5–7 mm.) and strongly deflexed, those above laxly horizontal, 30–38 cm. long, 5–7.5 cm. broad, subsessile, evenly pinnatifid almost to the costa nearly throughout, pinnate at base; costae thinly hirtellous above, glabrate beneath and bearing a few thin broad brownish appressed deciduous scales; pinnules or segments 20–25 pairs below the lobate-serrate acuminate apex, the 2 or 3 basal pairs sessile or subsessile, the others fully adnate and lightly joined by a narrow decurrent wing, more broadly so toward the apex; segments in general 2.5–2.8 cm. long, 6–10 mm. broad, oblong, obtuse or acutish, strongly falcate, subentire in basal portion, broader and pinnately lobed toward apex, the lobes oblique, obtuse, 2–2.5 mm. broad, 1–2 mm. long, varying according to fertility; costules delicate, elevated, glabrate, bearing a few thin brownish scales beneath; veins about 16 pairs, free, those of the

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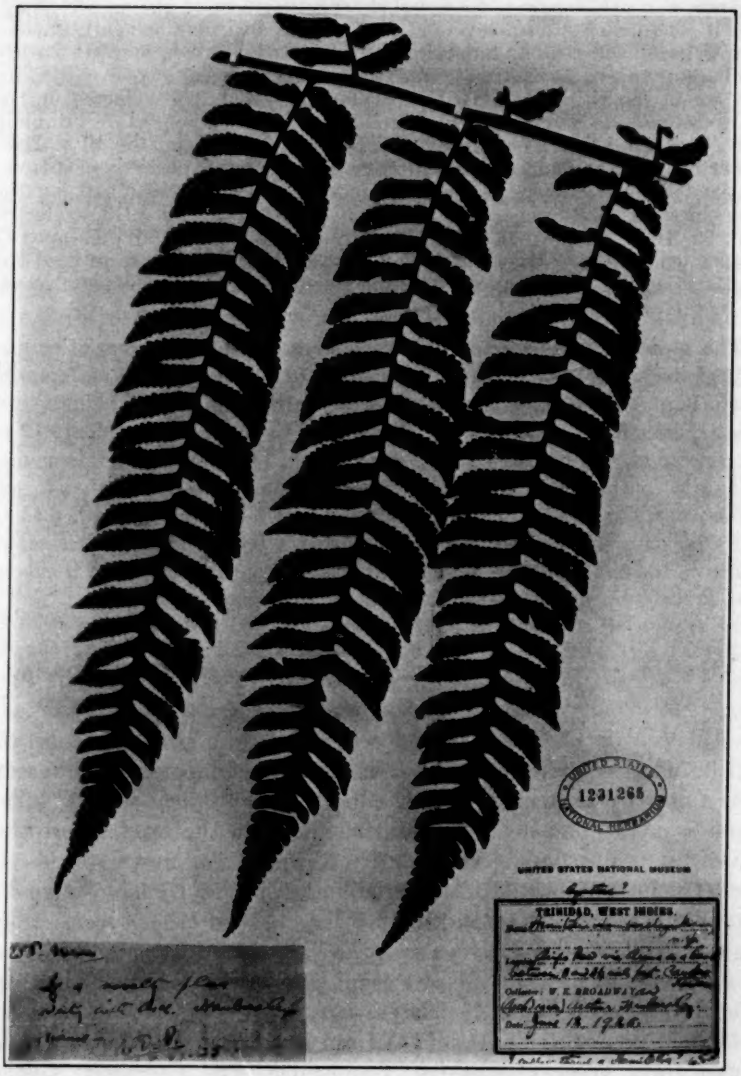


Hemitelia Hombersleyi Maxon, sp. nov.—The type specimen, at two-fifths natural size.

larger lobes with 2 to 4 pairs of pinnately arranged branches, elevated, glabrate beneath, bearing occasional short setiform hairs above; sori small, 2 or 3 (4) to each group of veinlets, occupying an irregular nearly medial zone between the costa and margin; indusium a pale brown, saccate, usually bilobate or trilobate, proximal scale; receptacle globose.

Type in the U. S. National Herbarium, no. 1,231,265, collected on the "Aripo Road, via Arima, on a bank between 3 and 3¼ mile posts," Trinidad, June 12, 1925, by A. Hombersley, this being the middle portion of a blade. Other material at hand consists of the apex and basal portions of a frond of the type collection; *Broadway* 6118, collected April 16, 1926, on the Blanchisseuse Road, near the 10½ mile post; *Broadway* 5913, collected Jan. 29, 1926, on the Las Lapas Road; and an entire frond with apex of caudex, collected by Mr. Hombersley (no. 208), Jan. 29, 1926, on the "Las Lapas Road, on left, about ½ mile from junction with Blanchisseuse Road, at 2000 ft. elevation."

This ample series of specimens shows no more than normal variation and indicates a species which, though allied to *H. Wilsoni* Hook.,[2] of Jamaica, Porto Rico, and Hispaniola, differs notably in size and essential characters. That species has, for example, the pinnae up to 85 cm. long, oblong, 12 to 25 cm. broad, the pinnules up to 14 cm. long, 1 to 2 cm. broad, long-acuminate to conspicuously attenuate at apex, and pinnatifid (rather than lobed) below that, the lobes 3 to 8 mm. long and 3 to 5 mm. broad, with 6 to 10 pairs of veins, the costae and veins bearing a few appressed *white* scales beneath, the numerous sori more than twice as large as those of *H. Hombersleyi*, and the huge indusium *whitish*, rather than pale brown.

ZOOLOGY.—*Fresh-water Ostracoda from Massachusetts.*[1] NORMA C. FURTOS, Western Reserve University. (Communicated by WALDO L. SCHMITT.)

The earliest reference to fresh-water Ostracoda in Massachusetts was a note by Haldeman in 1842 concerning a "*Cypris scabra*" taken from a small pond near Cambridge, but from the brief description given,[2] it is not possible to identify it with any known species. In 1905 Cushman reported and figured a new species, *Cyprinotus americanus*, from Nantucket, and in 1907 listed seven other species, none new, as follows: *Cypricercus passaicus* (syn. *Spirocypris passaicus*) from Wellesley; *Eucypris virens* (syn. *Cypris virens*) from Arlington; *Eucypris fuscata* (syn. *Cypris fuscata*) from Cambridge; *Eucypris reticulata* (syn. *Cypris reticulata*) from Brookline; *Cypridopsis vidua vidua* from West Cambridge, Cambridge, and Cohasset; *Cypria*

[2] Hook. in Hook. & Baker, Syn. Fil. 30. 1865; Maxon, Contr. U. S. Nat. Herb. 17: 416. pl. 18. 1914.

[1] Received August 15, 1935.

[2] "Shell modioliform rough, inflated, thickly covered with bristles; colour (of the dead shell) pale livid, or corneus. Length 1½, height 1 millimeter." (Haldeman.)

(*Cypria*) *elegantula* (syn. *Cypria exsculpta*) from Woods Hole and Auburndale; *Candona candida* from Arlington and Auburndale. The above summarizes about everything that has been known concerning the fresh-water Ostracoda of Massachusetts. That a group of Crustacea as common and abundant as this should be so consistently overlooked by aquatic biologists is most surprising.

This report is based chiefly upon a series of collections taken by the author during June, July, and August of 1933 from various fresh-water pools, ponds, marshes, and rivers of Cape Cod and the Elizabeth Islands. Since only remnants of the spring fauna remain by early June, the number of species obtained has in no way exhausted the possibilities of the region. Six of the species recorded by Cushman do not appear in the present collection. Of the fourteen that were taken, three are new species and two new varieties of known species. As two, *Cypridopsis vidua vidua* (O. F. Müller) and *Cypria* (*Cypria*) *elegantula* (Lilljeborg), have already been reported by Cushman, they will not be further noticed in this paper. Besides the collections from the Cape, material received from the United States National Museum revealed two additional species from Hampshire County.

The work was done under the auspices of the Marine Biological Laboratory, Woods Hole, Mass., and the Biological Laboratory of Western Reserve University. Facilities at Woods Hole were made available through the kindness of Dr. M. H. Jacobs, the Director, and at Western Reserve University by Dr. J. Paul Visscher. Specimens of all species described have been deposited in the United States National Museum. In the case of holotypes and male paratypes, body parts are placed on permanent slides and valves in specially labelled vials.

Family CYPRIDAE
Subfamily CANDOCYPRINAE
Tribe CYCLOCYPRINI
Genus CYPRIA Zenker, 1854

The genus is divided into two subgenera *Cypria* and *Physocypria*, according to the character of valve-margins. In *Cypria* margin of each valve is smooth while in *Physocypria* margin of right valve is distinctly tuberculated and that of left valve smooth.

Cypria (Cypria) palustera n. sp. Fig. 1.

Specific characters—Female, from the side: Somewhat elongate, dorsal margin smoothly arched, ventral margin straight; height slightly less than two-thirds of length, highest just behind middle; extremities broadly rounded, the anterior broader; well developed hyaline border along an-

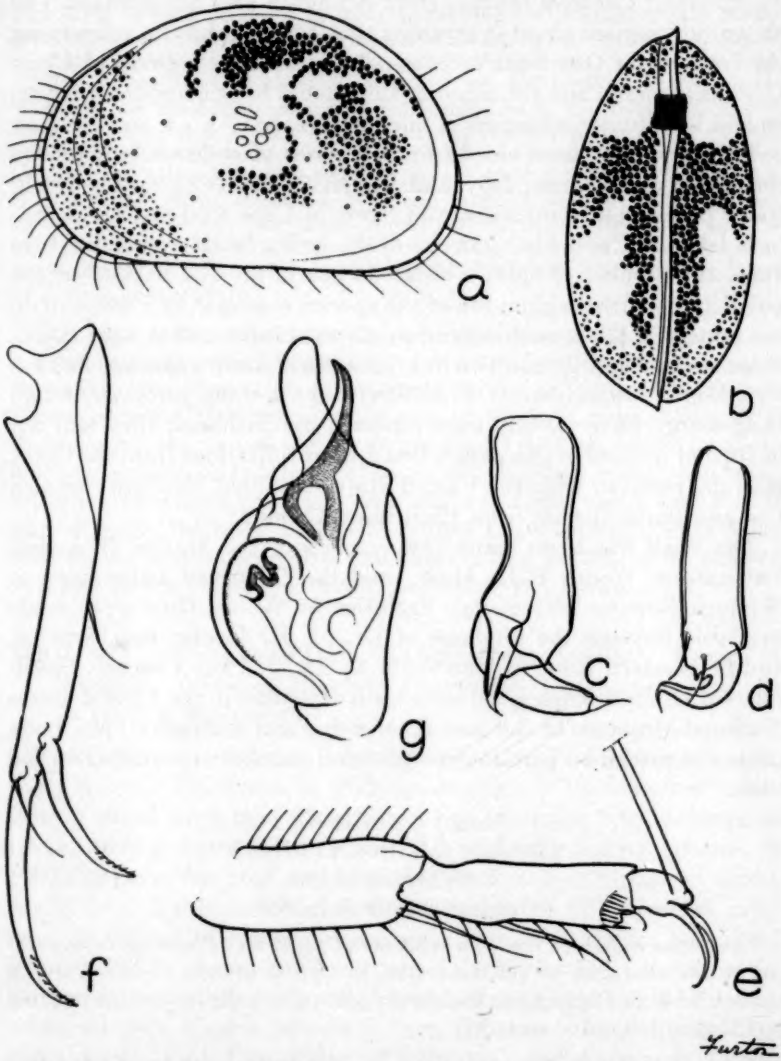


Fig. 1.—*Cypria* (*Cypria*) *palustera* new species. *a*, left valve, adult female; *b*, adult male, viewed from above; *c-d*, prehensile palps; *e*, scratch-foot, female; *f*, caudal ramus, female; *g*, penis.

terior, antero-ventral and posterior margins of left valve and along entire free margin of the right. From above: Moderately compressed, breadth slightly less than one-half of length, broadest in middle; left valve longer than right, extending clearly beyond right at each end; extremities narrowly rounded, the anterior somewhat narrower. Surface of valves smooth, with large scattered puncta, hairless except for a few slender marginal hairs. Color light brown with dark brown areas; one large diffusely pigmented area at anterior extremity, another darker dorso-lateral area behind ocular region, another diffuse area in postero-lateral region. Length 0.63, height 0.38, breadth 0.29 mm. Natatory setae of second antenna extend beyond tips of terminal claws by three times length of claws. The two short terminal setae of scratch-foot equal in length, one and one-half times longer than terminal segment. Caudal ramus only very slightly curved, ten times longer than narrowest width, dorsal margin smooth; dorsal seta about one-half length of subterminal claw, removed from claw by three times width of ramus; claws gently curved, decidedly subequal, each weakly denticulate near tip; terminal claw slightly exceeding one-half length of ramus; terminal seta one-third length of terminal claw.

Male smaller than female, otherwise similar. Length 0.55 mm. Prehensile palps unequal, the larger with propodus narrowest in middle by virtue of sinuate outer margin and with distal process extending beyond outer margin of sharply geniculate moderately inflated dactylus; propodus of smaller palp elongate, cylindrical, dactylus short, slender, hook-like. Ejaculatory duct with five crowns of spines. Penis with narrow globular base and two subequal terminal lobes, the larger lobe finger-like with rounded apex, the smaller narrowed, curved distally toward larger lobe.

C. opthalmica (Jurine) may be distinguished from the above species by the more gibbous form of valves when viewed from the side, by the more nearly equal length of valves when viewed from above, by the character of the brown pigmentation which occurs as very small speckles over whole of valve surface, by the ciliated dorsal margin of caudal ramus and by less geniculate dactyli of prehensile palps. The pigmentation of *C. inequivalva* Turner (1895) appears to be rather similar to *C. palustera*, but when viewed from above the left valve projects beyond the right at anterior extremity only, and caudal ramus much more sharply curved with dorsal seta lacking. *C. javana* Muller (1906) may at once be distinguished from the species from Cape Cod by the very nearly equal valves when viewed from above and by the very elongate dorsal seta on caudal ramus.

Occurrence—Cape Cod: Type locality, marsh between Barnstable Village and East Sandwich (June 9, 1933). Fresh-water side pool of Salt Marsh, West Falmouth (June 16, 1933); pond on shore of Nonamesset Island (June 22, 1933). Female holotype, U. S. Nat. Mus. No. 71409. Male paratype, U. S. Nat. Mus. No. 71410.

Cypria (Physocypria) posterotuberculata n. sp. Fig. 2

Specific characters—Female, from the side: Somewhat elongate, height greater than one-half of length, highest behind middle; ascending slope of dorsal margin gently arched, descending slope steeper; extremities broadly

rounded, the anterior narrower; ventral margin of right valve straight, that of left slightly convex; valves very nearly equal, the left somewhat longer; posterior extremity of right valve with distinct row of tubercles extending beyond margin, anterior and ventral margins of same valve appear smooth, but under high power of microscope very obscure tubercles may be seen inside these margins; submarginal zone evident along anterior margin of left valve, pore-canals obscure; entire free margin of left valve with fairly wide hyaline border, anterior and posterior margins of right valve with

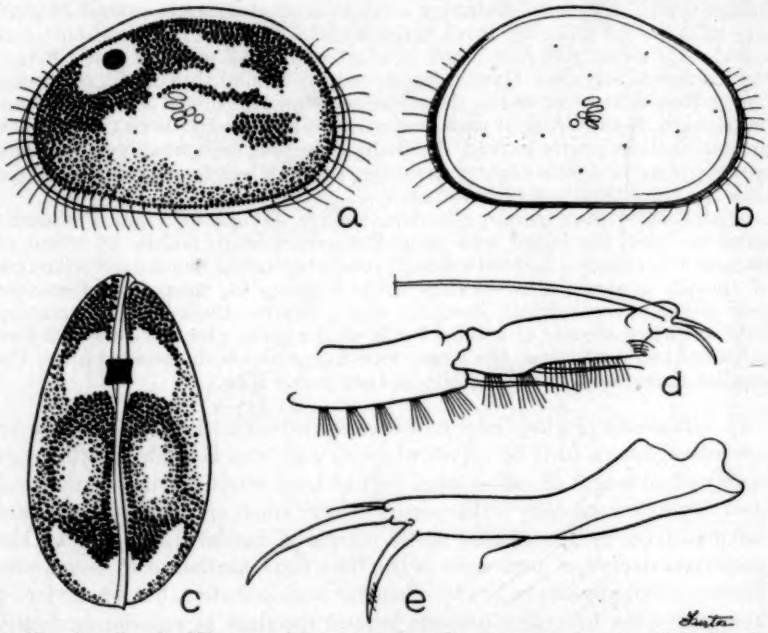


Fig. 2.—*Cypria* (*Physocypria*) *posterotuberculata* new species. *a*, adult female, viewed from left; *b*, right valve, adult female; *c*, adult female, viewed from above; *d*, scratch-foot, female; *e*, caudal ramus, female.

narrower border. From above: Moderately tumid, breadth exceeding one-half of length, broadest behind middle; sides evenly curved, extremities rounded, the anterior narrower; left valve enclosing the right, extending slightly beyond the right at each end. Surface of valves smooth, with a few scattered puncta and slender marginal hairs. Color light with narrow chestnut-brown band close to and parallel with all of valve margin including the dorsal, while in anterior portion of valve this band is diffusely widened to form a light brown patch which passing under eye as narrow band joins a dorso-lateral patch behind ocular region. Length 0.72, height 0.45, breadth 0.40 mm. Natatory setae of second antenna extend beyond tips of terminal claws by four times length of claws. The two short terminal setae of scratch-foot very nearly equal in length, the shorter about as long as terminal segment, the other slightly longer. Caudal ramus curved, nine and one-half

times longer than narrowest width, dorsal margin smooth; dorsal seta slightly exceeding one-half length of subterminal claw, removed from claw by somewhat less than three times width of ramus; claws decidedly subequal, gently curved, the subterminal with a comb of delicate denticles near tip, the terminal smooth, less than one-half length of ramus; terminal seta one-third length of terminal claw.

Male unknown.

Presence of distinct tubercles along posterior margin of right valve with smooth appearance of rest of margin, together with character of pigmentation serve to distinguish this species from others of the subgenus. The valves rather closely resemble *Cypria* (*Cypria*) *palustera* in proportions and coloration, but the latter is distinctly larger.

Occurrence—Cape Cod: Type locality, Palmer's Pond in Falmouth (Aug. 26, 1933). Female holotype, U. S. Nat. Mus. No. 71412. Paratypes, U. S. Nat. Mus. No. 71413.

Cypria (Physocypria) globula Furtos, 1933

Cypria (*Physocypria*) *globula* Furtos, Ohio Biol. Survey Bull. 29 (Vol. 5, No. 6): 468–469, t.16, figs. 1–9. 1933.

A rather common species, occurring in ponds, marshes, small lakes and rivers from late March to October. Numerous records from Ohio and Florida as well as from Massachusetts indicate that the species is probably widely distributed over the eastern and mid-western sections of the United States.

Occurrence—Cape Cod: Lake Leman, Falmouth Hts. (June 9, 1933); Marston's Mills Pond near Hyannis (June 9, 1933); Quostinet River, Mashpee (June 9, 1933); Oyster Pond, Woods Hole (June 12, 1933); marsh near Sandwich (June 15, 1933); Oyster Pond, Falmouth (Aug. 26, 1934).

Genus CYCLOCYPRIS Brady & Norman, 1889

Cyclocypris forbesi Sharpe, 1897 Fig. 3

Cyclocypris forbesi Sharpe, Bull. Ill. State Lab. Nat. Hist. 4: 432, 433, pl. 41, figs. 1–7. 1897.

Specific characters—*Male*, from the side: Sub-ovoid, height equal to two-thirds of length, highest behind middle; dorsal margin rather boldly arched with descending slope steeper than ascending slope; extremities broadly rounded, the anterior narrower; ventral margin slightly convex; pore-canal zone rather broad along free margin of right valve, the canals slender; pore-canal zone very narrow along margin of left valve, the canals obscure; right valve with narrow hyaline border along anterior and postero-ventral margins; left valve with similar border along postero-ventral margin while border along anterior margin is so much narrower that it is visible only under higher powers of microscope; pore-canal zone of each valve quite dark, longer canals each ending in a papilla bearing a slender marginal hair. From above: Moderately tumid, sides evenly curved, breadth three-fifths of length, broadest somewhat behind middle; right valve projecting beyond left at each end; anterior extremity somewhat pointed, the posterior nar-

rowly rounded. Surface with very sparsely scattered, but well defined dark brown tubercles, each bearing a slender hair; the tubercles particularly evident projecting beyond sides of valves when viewed from above. Entire surface with exception of small ocular areas delicately speckled with

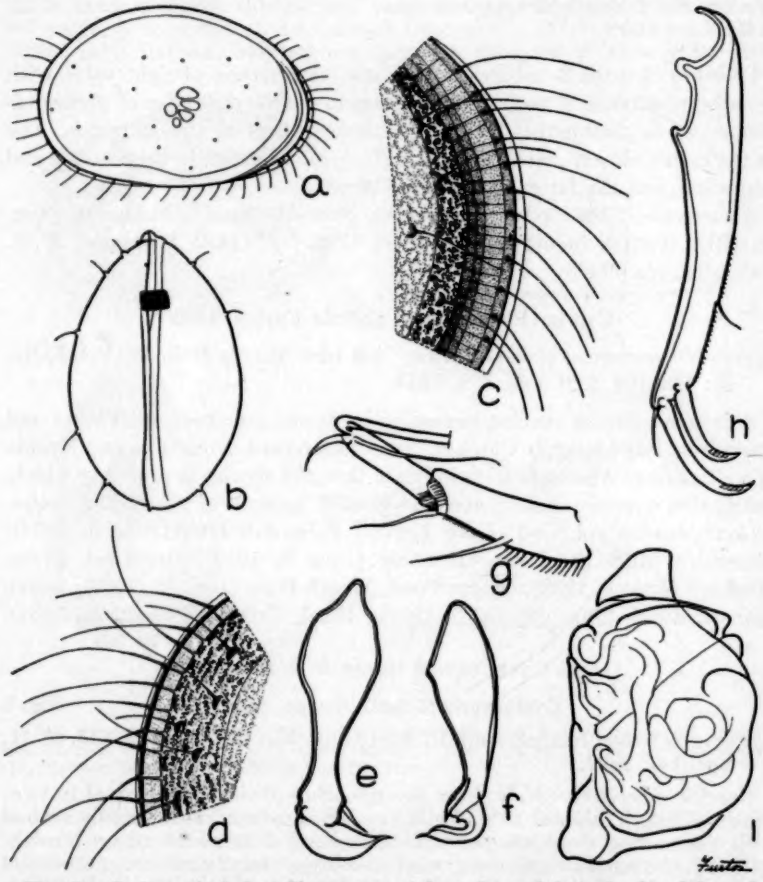


Fig. 3.—*Cyclocypris forbesi* Sharpe. *a*, right valve, adult male; *b*, adult male, viewed from above; *c*, anterior margin, right valve; *d*, anterior margin, left valve; *e–f*, prehensile palps; *g*, distal portion of scratch-foot; *h*, caudal ramus; *i*, penis.

chestnut-brown. Length 0.58, height 0.38, breadth 0.35 mm. Natatory setae of second antenna extend beyond tips of terminal claws by twice length of claws. Prehensile palps very much elongated for *Cyclocypris*, unequal in size, the larger with propodus widest near proximal end and with both outer and inner margins sinuated to form a narrow neck-like region near distal end, dactylus short, moderately inflated with outer margin smoothly curved,

inner margin approximately straight; propodus of smaller palp broadest near proximal end, outer margin convex, inner sinuated, dactylus short, narrow, hook-like. Terminal segment of scratch-foot four times longer than wide; the shortest terminal seta evenly curved, one-half length of segment. Caudal ramus gently curved, ten and one-half times longer than narrowest width, distal half of dorsal margin delicately ciliated; dorsal seta slightly greater than one-third length of subterminal claw, removed from claw by two and one-third times width of ramus; claws subequal, sharply curved at tips, weakly pectinate, terminal claw one-third length of ramus; terminal seta about one-third length of terminal claw. Ejaculatory duct quite small, with crowns of spines surrounding openings easily visible, the others quite obscure. Penis roughly quadrangular with a beak-like terminal lobe.

Occurrence—Cape Cod: Many males were taken from Weak's Pond in Falmouth (June 19, 1933). Otherwise known from Illinois.

Cyclocypris cruciata n. sp. Fig. 4

Specific characters—Male, from the side: Stout, gibbous, height slightly exceeding one-half of length, highest somewhat behind middle; left valve longer and higher than right; ascending slope of dorsal margin straight in left valve, gently arched in the right; apex of right valve broadly rounded, that of the left narrower; descending slope of dorsal margin boldly arched in each valve; extremities broadly rounded, the anterior clearly narrower. Anterior margin of right valve with a rather conspicuous hyaline flange composed of two layers of approximately equal width, an outer reddish brown segmentally arranged layer with scalloped border and an inner more hyaline layer. The flange originates near postero-dorsal angle of anterior margin, extending to beginning of ventral margin where it ends abruptly. Anterior margin of left valve with an ordinary hyaline border comparable to inner layer of right valve-flange, does not end abruptly and without any evidence of curious scalloped structure characteristic of right valve. Submarginal line rather widely removed from anterior margin of left valve, pore-canals slender, each bearing a marginal hair; submarginal zone of right valve about one-half as wide; each valve with hyaline border lacking along ventral and posterior margins. From above: Tumid, ovoid, sides evenly curved, breadth equal to height, broadest slightly behind middle; anterior extremity pointed, the posterior broadly rounded; left valve projecting slightly beyond right at each end. Surface of valves smooth with a few scattered hairs near margins. Color light with dark blue bands so arranged that from above they appear as a large X crossing behind ocular region, while from the side the pigmentation extends over all of surface except ocular region and a larger dorso-lateral area behind the eye. Length 0.53, height 0.37, breadth 0.37 mm. Natatory setae of second antenna extend beyond tips of terminal claws by not quite length of claws. Prehensile palps small, propodi rather short, roughly cylindrical, approximately equal in size; dactyli short, the one slender, hook-like, the other moderately inflated with outer margin smoothly curved. Terminal segment of scratch-foot three times longer than wide, the short terminal seta gently curved, one-third length of segment. Caudal ramus straight, twelve and one-half times longer than narrowest width, dorsal margin smooth; dorsal seta absent, but with a papilla marking place where seta ordinarily is found in the genus; claws curved, very slightly subequal, weakly denticulate near tips; terminal seta well developed, almost three-fourths length of terminal claw.

Ejaculatory duct with five crowns of spines. Penis globular with two subequal terminal lobes, the larger triangular with pointed apex, the other more slender, smoothly rounded distally and curved toward apex of larger lobe.

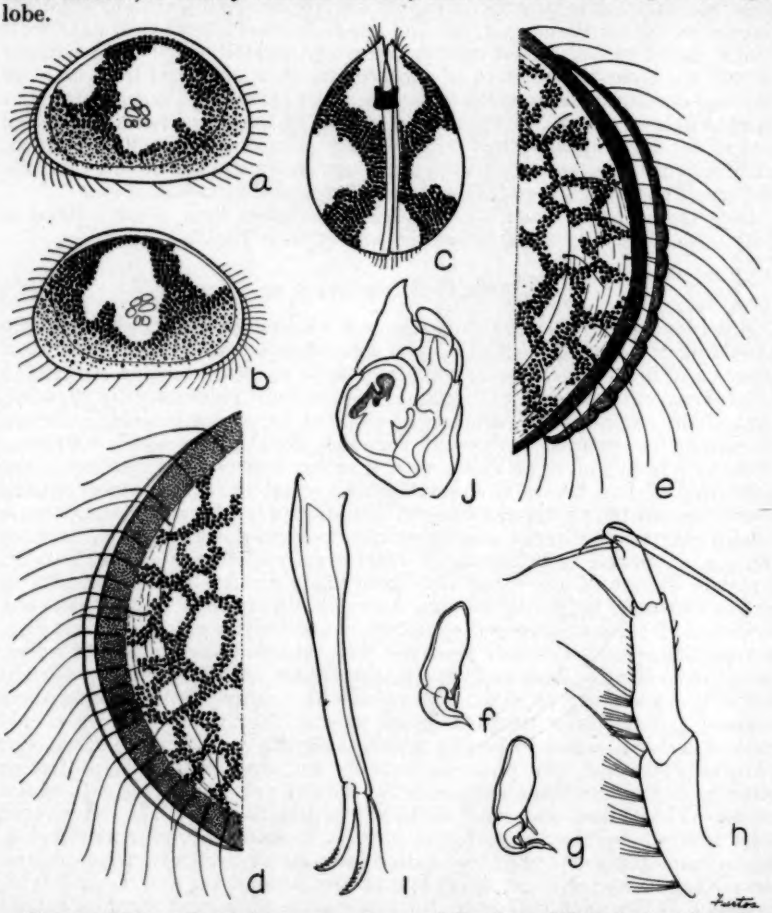


Fig. 4.—*Cyclocypris cruciata* new species. *a*, left valve, adult male; *b*, right valve, adult male; *c*, adult male, viewed from above, *d*, anterior extremity, left valve; *e*, anterior extremity, right valve; *f–g*, prehensile palps; *h*, scratch-foot, male; *i*, caudal ramus, male; *j*, penis.

Female unknown.

Occurrence—Cape Cod: Type locality, Marston's Mills Pond near Hyannis (June 9, 1933) where several males were taken. An empty shell was taken from a marsh between Barnstable Village and East Sandwich on the same day. Otherwise known from Lake Chautauqua, New York, where several males were collected by the author Aug. 12, 1932. Male holotype. U. S. Nat. Mus. No. 71416. Paratypes, U. S. Nat. Mus. No. 71417.

Cyclocypris ampla Furtos, 1933

Cyclocypris ampla Furtos, Ohio Biol. Survey Bull. **29.** (Vol. 5, No. 6): 461–462, t. 14, figs. 1–7. 1933.

This is the largest of the known species of *Cyclocypris* occurring in North America. Length 0.7–0.8 mm. Readily identified by its size, very tumid valves and glossy chestnut-brown color which on closer examination appears as densely situated brown speckles on yellow-brown background.

Occurrence—Cape Cod: Deep Pond at Hatchville (June 23, 1933). Otherwise known from Ohio and Lake Chautauqua in New York.

Cyclocypris laevis (O. F. Müller, 1776)

Cypris laevis (part.) O. F. Müller, Zool. Dan. Prodr.: 198. 1776.

Cyclocypris laevis Sars, Crust. Norway **9:** 93–94, t. 43, fig. 2, 1928.

non *Cyclocypris laevis* Sharpe, Proc. U. S. Nat. Mus. **35:** 408–410, t. 50, fig. 5; t. 54, figs. 5–7. 1908.

A widely distributed form often confused with *C. ovum* (Jurine) and *C. serena* (Koch). The specimens taken from Massachusetts agree quite well with figures and description given by Sars (1928). Characterized by small size (0.5 mm. in length for female) more gibbous than *C. ovum* when viewed from the side, surface of valves delicately speckled with brown. Viewed from above, anterior extremity pointed, the posterior broadly rounded, greatest breadth distinctly behind middle.

Occurrence—Hampshire County. Otherwise known from Europe and Central Asia.

Tribe CANDONINI

Genus CANDONA Baird, 1842

Candona caudata Kaufmann var. **ciliata** n. var. Fig. 5

Specific characters—Female, from the side: Elongate-reniform, height about one-half of length, highest behind middle; ascending slope of dorsal margin gently arched to rounded apex, descending slope steep, producing truncate appearance to posterior portion of right valve; anterior extremity broadly rounded, posterior extremity narrower; ventral margin sinuate; infero-posteal region of left valve with ventral sinuation producing a somewhat projecting postero-ventral prominence, this region of right valve without such prominence; submarginal line removed from entire free margin, more widely removed along posterior margin, pore-canals each bearing a slender marginal hair. From above: Moderately compressed, sides rather unevenly curved, breadth somewhat less than one-half of length, broadest behind middle; anterior extremity pointed, the posterior narrowly rounded; left valve projecting beyond right at each end. Surface of valves with a few small scattered tubercles, those near extremities bearing slender hairs. Length 0.93, height 0.48, breadth 0.41 mm. Medial-distal seta of penultimate mandibular palp-segment smooth. Penultimate segment of scratch-foot divided, shortest terminal seta pectinate, three times length of terminal segment. Caudal ramus gently curved, thirteen times longer than narrowest

width, distal half of dorsal margin ciliated; dorsal seta three-fourths length of subterminal claw, removed from claw by three times width of ramus; claws subequal, gently curved, delicately pectinate, the terminal slightly greater than one-third length of ramus; terminal seta one-fourth length of

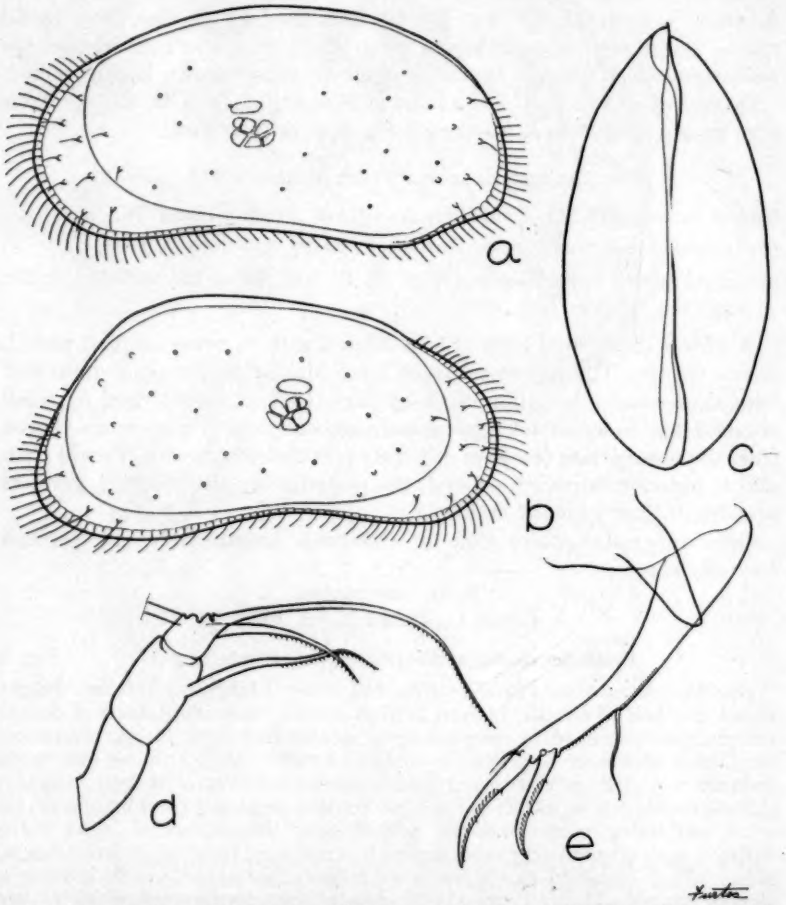


Fig. 5.—*Candona caudata* var. *ciliata* new variety. *a*, left valve, adult female; *b*, right valve, female; *c*, adult female, viewed from above; *d*, distal portion of scratch-foot; *e*, caudal ramus and genital lobe.

terminal claw. Genital lobes well developed, each with a long finger-like posterior protuberance.

Male unknown in adult condition. Two immature specimens with testes and copulatory organs partially developed were present in the collection from Cape Cod.

This is a smaller stouter variety of the European species. *Candona caudata* as described by Kaufmann (1900) and Sars (1928) differs from the above species in the fact that right valve has some indication of postero-ventral prominence and that dorsal margin of caudal ramus is quite smooth. In other respects the North American form closely resembles that of Europe.

The species should not be confused with *Candona intermedia* Furtos (1933) which is also characterized by a similar postero-ventral prominence of left valve. The latter form is much larger (1.7 mm. in length for female), posterior extremity of valves more elongated when viewed from the side and shortest distal seta of scratch-foot four times longer than terminal segment.

Occurrence—Cape Cod: Marsh between Barnstable Village and East Sandwich (June 9, 1933). Female holotype, U. S. Nat. Mus. No. 71420.

Candona annae Méhes var. **septentrionalis** n. var. Fig. 6

Specific characters—Male, from the side: Elongated, height equal to one-half of length, highest behind middle; ascending slope of dorsal margin gently curved, apex broadly rounded, descending slope boldly arched; ventral margin sinuate; extremities broadly rounded, the anterior narrower; submarginal zone not apparent. From above: Compressed, elliptical, breadth somewhat greater than one-third of length, broadest behind middle; left valve enclosing right, extending beyond right at each end; extremities pointed, the anterior clearly narrower. Surface of valves smooth with a few marginal hairs. Length 0.92, height 0.46, breadth 0.34 mm. Medial-distal seta of penultimate mandibular palp-segment smooth. Prehensile palps unequal in size, weakly falciform, outer margin of propodi sinuate, dactyli rather short, that of larger palp inflated along outer margin. Penultimate segment of scratch-foot undivided, the shortest terminal seta curved, about one and one-half times length of terminal segment. Caudal ramus straight, fourteen times longer than narrowest width, dorsal margin smooth; dorsal seta approximately two-fifths length of subterminal claw, removed from claw by two and one-half times width of ramus; claws very slender, curved, delicately pectinate, subequal, the terminal one-half length of ramus; terminal seta one-fifth length of terminal claw. Ejaculatory duct with five crowns of spines. Penis triangular with rounded apex, quadrangular lateral lobe and rounded terminal lobe only slightly narrower than apex of base, but projecting considerably beyond the latter.

Female unknown.

The above species differs from *Candona annae* Méhes (1913) in a few minor details. Viewed from above, the latter species is somewhat more pointed anteriorly and left valve projects to a lesser extent beyond the right at posterior end. Viewed from the side proportions and valve-surface of the two forms are identical, but *Candona annae* has in addition a rather definite submarginal zone. Appendages and copulatory organs of the two closely correspond, but terminal seta of caudal ramus is definitely longer, stronger in the specimen from Massachusetts. *Candona annae* was first reported by Méhes for South America with terminal seta of caudal ramus absent. The

author has recently described the species for Florida with this seta very delicate, almost obscure. Presence of a well developed terminal seta, together with absence of submarginal zone on valves constitute the chief characters of the new variety.

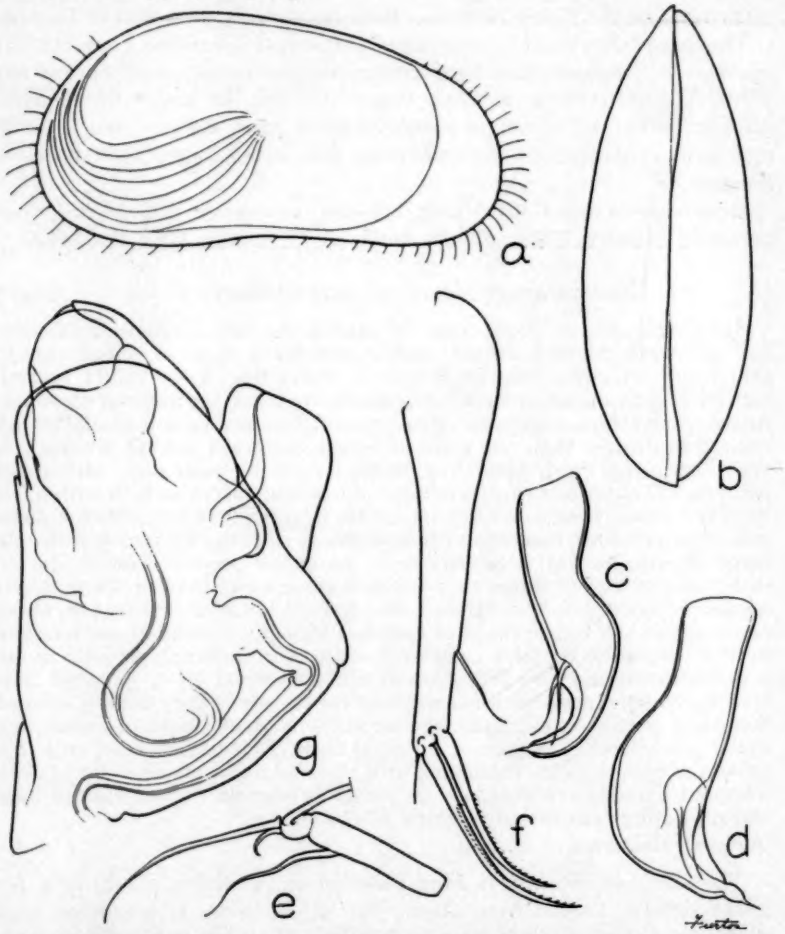


Fig. 6.—*Candona annae* var. *septentrionalis* new variety. *a*, right valve, adult male; *b*, adult male, viewed from above; *c–d*, prehensile palps; *e*, distal portion of scratch-foot; *f*, caudal ramus, male; *g*, penis.

Candona annae should not be confused with *Candona elliptica* Furtos (1933). Male of the latter species is narrower in posterior region of valves when viewed from the side, marginal hairs considerably shorter. Viewed from above, *Candona elliptica* is broadest in middle whereas *Candona annae*

is broadest behind middle. Terminal lobe of penis projects only slightly beyond apex of base in *Candona elliptica* while in *Candona annae* this lobe is very clearly longer.

Occurrence—Cape Cod: Woods Hole in field drainage-ditch (June 12, 1933). Male holotype, U. S. Nat. Mus. No. 71421.

Candona elliptica Furtos, 1933

Candona elliptica Furtos, Ohio Biol. Survey Bull. **29**, (Vol. **5**, No. 6): 482–483, t. 12, figs. 1–7. 1933.

An elongated, low-arched, very compressed *Candona* which may readily be confused with *Candona annae* as pointed out in the discussion of the latter species. Length 0.90–0.94 mm.

Occurrence—Cape Cod: Quostinet River at Mashpee where a single male was taken. Otherwise known from Lake Erie region of Ohio.

Candona punctata Furtos, 1933

Candona punctata Furtos, Ohio Biol. Survey Bull. **29**, (Vol. **5**, No. 6): 485–486, t. 13, figs. 2–8. 1933.

Easily recognized by stout gibbous truncate form when seen from the side, and by tumid spindle-shape with pointed extremities when seen from above. Surface of valves pitted and covered with long hairs. Length of female 0.85–0.90 mm. Male somewhat larger.

Occurrence—Cape Cod: Marsh between Barnstable Village and East Sandwich (June 9, 1933), woodland pools on Nonamesset Island (June 22, 1933). Otherwise known from Ohio.

Candona decora Furtos, 1933

Candona decora Furtos, Ohio Biol. Survey Bull. **29**, (Vol. **5**, No. 6): 477–478, t. 8, figs. 4, 5; t. 9, figs. 21, 22; t. 11, figs. 5, 6. 1933.

Large forms, posterior portion of female valves truncate but with dorsal part of posterior margin somewhat swollen, posterior portion of male valves broadly rounded. Surface of valves appear obscurely reticulate, particularly near posterior extremity. Penis characteristic with conical lateral lobe and small terminal lobe projecting beyond apex of base. Length of female 1.1–1.3 mm. Male slightly larger.

Occurrence—Hampshire County. Otherwise known from Ohio where the species is particularly abundant in temporary leafy pools of Beech-Maple forests near Cleveland. Occasionally in ponds and lakes. Spring.

Subfamily CYPRINAE

Genus CYPRICERCUS Sars, 1895

Cypricercus splendida Furtos, 1933

Cypris (*Cypricerus*) *splendida* Furtos, Ohio Biol. Survey, Bull. 29 (Vol. **5**, No. 6). 455–456, t. 3, figs. 1–7. 1933.

Large, brightly banded forms readily confused with *Eucypris fuscata* (Jurine) from which it may be distinguished by relatively hairier valve-surface, more numerous surface tubercles and the constant presence of males. Length of female amounting to 1.75 mm. Male slightly smaller, characterized by testis forming spiral coil in anterior portion of valve-chamber. The species should not be confused with *Cypricercus passaicus* (Sharpe, 1903) which according to Sharpe's figures is a blunter form with valves less attenuated posteriorly when viewed from the side, nor with the smaller, more gibbous *Cypricercus tincta* Furtos (1933).

Occurrence—Nonamesset Island in a small pond (June 22, 1933). Otherwise known from Ohio.

Family DARWINULIDAE

Genus DARWINULA Brady & Norman, 1889

Darwinula stevensoni (Brady & Robertson, 1870)

Darwinula improvisa Turner, Rept. Geol. Nat. Hist. Survey Minn., Ser. **2**, Zool.: 336, t. 81, figs. 1–3, 13. 1895.

Darwinula aurea, G. W. Müller, Das Tierreich **31**: 240. 1912.

Several specimens of this widely distributed species were taken from Massachusetts. The form is particular interesting in that eggs are not laid, but young reared in posterior valve-chamber of female. A gravid female with young well advanced has been deposited in the Museum.

Occurrence—Cape Cod: Marsh between Barnstable Village and East Sandwich, Lake Leman at Falmouth Heights (both of June 6, 1933). Otherwise known from Ohio, Georgia, Europe, and Asia Minor.

LITERATURE CITED

CUSHMAN, JOSEPH A. *A new Ostracod from Nantucket.* Amer. Nat. **39**: 791–793. 1905.

Ostracoda from South Eastern Massachusetts. Amer. Nat. **41**: 35–39. 1907.

FURTOS, NORMA C. *The Ostracoda of Ohio.* Ohio Biol. Survey Bull. **29**: (Vol. **5**: No. 6): 413–524. 1933.

HALDEMAN, S. S. *Description of a new species of Cypris.* Proc. Phil. Acad. Nat. Sci. **1**: 184. 1842.

KAUFMANN, A. *Cypriden und Darwinuliden der Schweiz.* Rev. Suisse Zool. **8**: 209–423, pls. 15–31. 1900.

MÉHES, GYULA. *Süsswasser-Ostracoden aus Columbien und Argentinien.* Bull. Soc. neuchateloise Scien. nat. **5**: 639–663. 1913.

MÜLLER, G. W. *Ostracoda aus Java (gesammelt von Prof. K. Kraepelin.).* Mt. Mus. Hamburg. **23**: 139–142. 1906.

SARS, G. O. *An account of the Crustacea of Norway. 9, Ostracoda.* Bergen Museum Pub.: 1–277.

SHARPE, R. W. *Report on the fresh-water Ostracoda of the United States.* Proc. U. S. Nat. Mus. **26**: 969–1001. 1903.

TURNER, C. H. *Fresh-water Ostracoda of the United States. Part III of Entomostraca of Minnesota.* Rept. Geol. Nat. Hist. Survey Minn., Zool., Ser. **2**: 279–337. 1895.

CONCHOLOGY.—*Three new land shells from the southern United States.*[1] JOSEPH P. E. MORRISON, U. S. National Museum. (Communicated by PAUL BARTSCH.)

While overhauling the minute land shells of eastern North America in the collection of the United States National Museum, the writer discovered the following new species.

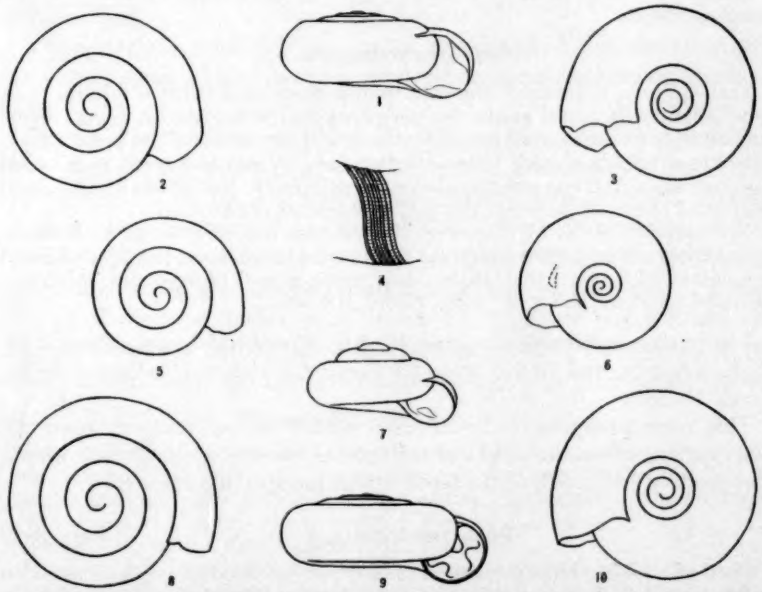
Pseudopunctum, new section

Sculpture as in *Punctum* s.s., but shell is furnished with a basal lamella just within the aperture. From its appearance in the material examined, this lamella is apparently absorbed on its inner end and formed on the outer, as the shell grows; specimens of all sizes examined showing it about the same distance within the aperture, and not repeated.

Type of section: *Punctum* (*Pseudopunctum*) *smithi*, described below.

Punctum (Pseudopunctum) Smithi, n. sp. Figs. 4–7

Shell minute, depressed as much as in *P. blandianum*, but with each whorl more flattened (oval in cross-section), which gives the entire shell a lower



Figs. 1–3. *Paravitrea roundyi*, n. sp. Holotype. Fig. 4. *Punctum* (*Pseudopunctum*) *smithi*, n. sp. Sculpture of body whorl. Figs. 5–7. *Punctum* (*Pseudopunctum*) *smithi*, n. sp. Holotype. Figs. 8–10. *Pilsbryna tridens*, n. sp. Holotype.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received September 24, 1935.

appearance, even when height and diameter are practically identical. Whorls 4¼ (maximum); later whorls with major growth riblets not prominent, and interspaces with 1–3 minor growth ridges; spiral lines of equal prominence; the two producing the characteristic beaded sculpture. Umbilicus about three times in major diameter of shell. Aperture wider than high, with simple, sharp lip. Basal lamella about one-fourth the height of aperture, not on a callous; lamella is about four times as long as wide, twice as long as high, sloping gradually both towards and away from the peristome. In fresh (translucent) shells, the spindle-shaped basal outline of the lamella is evident in umbilical view, close to the aperture margin.

The type, U. S. N. M. Cat. No. 318466a, was collected by H. H. Smith near Huntsville, Madison County, Alabama (Coll. No. 367). It measures: Height, 0.62 mm.; maj. diam., 1.15 mm.; min. diam., 1.0 mm. Height of aperture, 0.32 mm.; diam. of aperture, 0.37 mm ; umb. diam., 0.43 mm.

I have also seen specimens from Gurley, Madison County, and Wadley, Randolph County, Alabama, also collected by H. H. Smith, and a single specimen in the Lea Collection from "Kentucky, near Cincinnati, Ohio."

This species has a lighter color with a slight greenish cast, instead of brownish as in *Punctum* s.s., although the sculpture is essentially the same. One glance at the translucent base or into the aperture, and it can not be misunderstood.

Paravitrea roundyi, n. sp. Figs. 1–3

Shell minute, depressed, smooth, with a channeled suture. Whorls (4 in type) slightly flattened above the periphery and well rounded below. Aperture as wide as high; constricted by teeth and the curve of the penultimate whorl to a tricorn shape. There are two low, callous-like teeth in a radial row, one basal and one palatal, above the periphery. Umbilicus widely open, contained about 2½ times in the major diameter of the shell.

The type, U. S. N. M. Cat. No. 365154, was collected by P. V. Roundy near Dewey, Washington County, Oklahoma. It measures: Height, 0.7 mm.; maj. diam., 1.5 mm.; min. diam., 1.35 mm.; height of aperture, 0.5 mm.; diam. of aperture, 0.5 mm.; umb. diam., 0.6 mm.

I have seen specimens also from Hickory Creek Oklahoma, collected by P. V. Roundy, and from Cleveland County, Oklahoma, collected by R. Frank Hedges.

This species may be easily confused with *Hawaiia minuscula* from the same region, unless the height of the spire or the size of the nuclear whorls are carefully compared, or the teeth within the aperture are seen.

Pilsbryna tridens, n. sp. Figs. 8–10

Shell minute, umbilicate; whorls (4 in type) flattened above, well rounded below, regularly increasing in diameter; suture very shallow; growth lines not prominent, irregularly spaced. Umbilicus contained almost 3 times in major diameter of shell. The color is whitish (translucent) in the specimens seen. Aperture reniform, greatly constricted by the three teeth just within the simple sharp lip. The mid-parietal lamella is scalloped as in *P. castanea* and extends as far as can be seen into the aperture; the basal and palatal

teeth are blunt, very prominent, in a radial row (as in *Paravitrea*), with the palatal directly opposite the parietal lamella.

The type, U. S. N. M. Cat. No. 359722, was collected by P. V. Roundy near Strawn, Palo Pinto County, Texas. It measures: Height, 0.67 mm.; maj. diam., 1.6 mm.; min. diam., 1.47 mm. Height of aperture, 0.5 mm.; diam. of aperture, 0.5 mm.; umb. diam., 0.57 mm.

I have also seen specimens from Cleveland County, Oklahoma, collected by R. Frank Hedges.

This species may be easily distinguished from others of the genus by the presence of a tooth on the palatal wall. Discovery of *Pilsbryna* in the Ozark region, shows that the group more nearly parallels *Paravitrea* in distribution.

ENTOMOLOGY.—*New ichneumon-flies.*[1] R. A. CUSHMAN, Bureau of Entomology and Plant Quarantine. (Communicated by HAROLD MORRISON.)

This paper consists of the descriptions of one new genus and thirteen new species, and a few generic transfers and notes on synonymy, together with a key to the North American species of the genus *Neliopisthus*.

The descriptions of new species are published at this time to make the names available for use in important economic papers on the host insects.

Most of the material on which the discussion is based was received from various laboratories of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, type material of eight of the new species being reared at the Gipsy Moth Laboratory of that Bureau at Melrose Highlands, Mass., and that of another at laboratories devoted to the investigation of the oriental fruit moth. Types of four of the new species were received from State colleges and experiment stations, while material of the old species discussed was received largely from the Bureau of Entomology and Plant Quarantine.

Phaeogenes epinotiae, n. sp.

Very variable with respect to the color of the abdomen, which may range from piceous black with only the narrow apices of tergites 2–4 reddish, to black at base and apex with tergites 2–4 entirely ferruginous. The holotype is, in this respect, intermediate between the two extremes.

Female.—Length 4 mm., antennae 2.25 mm.

Head twice as broad as thick; temples strongly convex and nearly as long antero-posteriorly as short diameter of eye; occiput rather deeply concave; ocellar triangle weakly transverse, postocellar and ocellocular lines subequal, ocelli small; vertex, frons, and face opaque coriaceous with shallow punctures; eyes parallel above, weakly divergent below antennae and about their long diameter apart; antennae situated opposite lower fourth of eye;

[1] Received August 22, 1935.

face more than twice as broad as long, medially slightly elevated; clypeus much more than twice as broad as long, polished, with a single row of punctures near apex; malar space two-thirds as long as basal width of mandible; mandible long parallel-sided, upper tooth the longer; antennae slightly more than half as long as body, 22-jointed, thickened toward apex, basal joints of flagellum subequal in length and each much less than twice as long as thick. *Thorax* hardly as broad as head, slightly depressed, nearly twice as long as deep; mesoscutum densely punctate, scutellum sparsely so and shining; mesopleurum opaque, punctate, speculum polished; propodeum very densely rugulose opaque; areola coriaceous, about as broad as long, only obscurely closed posteriorly, petiolar area shallowly concave; radius slightly behind middle of stigma; nervellus perpendicular, broken far below middle; legs rather slender; hind coxa usually mutic, rarely with a very small carina. *Abdomen* narrower than thorax, granularly opaque; second tergite fully as long as first and as long as broad, gastrocoeli strongly transverse, situated nearly at basal third of tergite; ovipositor sheath slightly exserted.

Black; abdomen with tergites 2–4 narrowly reddish at apex or more extensively reddish, sometimes entirely so; clypeus and mandibles reddish piceous; antennae fusco-ferruginous, darker above, scape and pedicel piceous; wings hyaline, venation brown, radices white, tegulae piceous; legs piceous, coxae darker; apical joints of trochanters, tibiae, and tarsi more ferruginous.

Male.—Face and clypeus relatively narrower than in female; malar space shorter; antennae 23–25-jointed, fully three-fourths as long as body, tapering toward apex; abdomen narrower, barely fusiform.

Clypeus and mandibles white, clypeus sometimes fuscous in apical middle; face entirely black to entirely white, frequently white at sides and sometimes also in middle; legs more reddish, especially the front and middle legs; abdomen black with at most the narrow apical margins of middle tergites piceous.

Hosts.—*Epinotia nanana* Treitschke; *Recurvaria piceaella* Kearfott.

Type locality.—Georgetown, Maine.

Type.—No. 51056, U. S. National Museum.

Eleven females and 12 males received from the Gipsy Moth Laboratory, all but two reared from *Epinotia nanana*, the two from *Recurvaria piceaella*. All bear Gipsy Moth Laboratory No. 9590. Other localities, all in Maine, are Bristol, Harpswell, and Boothbay.

Diadromus subtilicornis (Gravenhorst)

Synonym.—*Herpestomus plutellae* Ashmead (new synonymy).

Discovery that Ashmead's species is a *Diadromus* and not an *Herpestomus* led me to compare it with *subtilicornis*, a species commonly recorded as a parasite of *Plutella maculipennis* in Europe. They are undoubtedly the same.

Chrysopoctonus chrysopae (Ashmead) Cushman

Synonym.—*Chrysopoctonus atriceps* (Ashmead) Cushman (new synonymy).

Because of the marked color antigeny I did not suspect the synonymy of *atriceps* when I transferred both names to my genus *Chrysopoctonus*.[2] The

[2] CUSHMAN. Proc. U. S. Nat. Mus 55: 518–520. 1919.

male (*chrysopae*) is largely black, while the female (*atriceps*) is uniformly ferruginous with the head black. The fact that they are the sexes of the same species is indicated by a series of 410 specimens (326 females and 84 males) collected in traps in connection with the Mediterranean fruit fly survey in Florida some years ago.

Aenoplex betulaecola Ashmead

Synonym.—Aeneoplex plesiotypus Cushman (new synonymy).

The characters employed to distinguish *plesiotypus* from *betulaecola* in the original description of the former have been found, on examination of many additional specimens reared principally from the oriental fruit worm, *Grapholitha molesta* (Busck), to be variable within the species.

Aenoplex molestae (Uchida), n. comb.

Hemiteles (*Isadelphus*) *molestae* Uchida, Insecta Matsumurana, **7**: 158, fig. 2. 1933.

This Japanese parasite of *Grapholitha molesta* (Busck) is very similar to the American parasite of the same host, *Aenoplex betulaecola* Ashmead, but is easily distinguished by its dorsally more shining thorax and abdomen, and the distinct white base of the hind tibia.

Genus APTESIS Foerster

Aptesis Foerster, Wieg. Archiv. **17**: 34; 1850; Verh. nat. Ver. preuss. Rheinland **25**: 173, 1868; Schmiedeknecht, Opusc. Ichn., fasc. 8: 650, 1905. Genotype, *Pezomachus sudeticus* (*Grav.*), by designation of Viereck, 1914.

Pezoporus Ashmead, Proc. U. S. Nat. Mus. **23**: 27; 1900 (not Foerster). Genotype, *Pezomachus nigrocinctus* (Grav.), by designation of Ashmead. Monobasic.

Microcryptus Thomson, Opusc. Ent., fac. **5**: 520; 1870, fasc. **9**: 850, 1883; Schmiedeknecht, Opusc. Ichn., fasc. **8**: 607, 1905. Genotype, *Cryptus erythrinus* Grav. Monobasic.

At the time of his original description of *Aptesis*, a genus of brachypterous females. Foerster referred to it, among other species, *sudeticus* (Grav.) and *nigrocinctus* (Grav.). In 1868, in his key to his family Phygadeuontoidae, he erected four new genera, including *Pezoporus*, for brachypterous species without indicating what species he intended to place in them. At the same time he maintained *Aptesis* in its original position in the Pezomachoidae. His notebooks give no further information as to the nature of the new genera, but it seems probable that he intended to divide *Aptesis* into several genera based on differences in the extent of venation in the wings.

In 1900 Ashmead transferred *nigrocinctus* (Grav.) to *Pezoporus*, designating it as the type of that genus, and placing it in the genus as a result of

his own reversal of the characters employed by Foerster to distinguish *Pezoporus* and *Stibeutes*. As a matter of fact, in Foerster's key the species runs to *Stibeutes*, and can not rightfully serve as type of *Pezoporus* Foerster.

Schmiedeknecht (1905) treats *Aptesis* as a subgenus of *Microcryptus* Thomson, ignoring the priority of *Aptesis*. The genotype of *Aptesis* is unknown to me, but there appears to be no doubt that it is congeneric with the fully-winged type of *Microcryptus*, as *nigrocinctus* certainly is.

The only described North American species heretofore assigned to *Aptesis* is *Cryptus micropterus* Say, renamed *pterigia* by Bradley because of preoccupation of Say's name. The fully-winged male of this species, reared with females from cocoons of *Neodiprion* sp. at Lincoln, Maine, is identical with a male identified by G. Stuart Walley as *Phaeogenes indistinctus* Provancher upon comparison with the type of that species. The synonymy, therefore, is as follows:

Aptesis indistincta (Prov.), n. comb.

Cryptus micropterus Say, Boston Journ. Nat. Hist. **1**: 238, 1935 (Leconte ed., vol. 2, p. 694), female, not *Aptesis microptera* (Gravenhorst). New synonymy.

Brachypterus micropterus Walsh, Can. Ent. **2**: 11, 1869.

Phaeogenes indistinctus Provancher, Add. Faune Ent. Can. Hym., p. 43, 1886, male.

Aptesis micropterus Cresson, Syn. and Cat. N. Amer. Hym., p. 199, 1887.

Aptesis pterigia Bradley, Bul. Brooklyn Ent. Soc. **13**: 100, 1918, female. New synonymy.

The following North American species with fully-winged females belong to *Aptesis* in this broader sense:

(Cryptus) Aptesis alacris (Cresson). New combination.
(Cryptus) Aptesis occidentalis (Provancher). New combination.
(Phygadeuon) Aptesis tegularis (Provancher). New combination.
(Cryptus) Aptesis brevicauda (Ashmead). New combination.

The following North American species, formerly placed by me in *Microcryptus*, appears better placed in *Chaeretymma*, where it is very closely allied to *parvula* (Gravenhorst) and *pleuralis* (Thomson): **(Cryptus) Chaeretymma osculata** (Prov.) (new combination.)

The new species described below is of the *Microcryptus* type.

Aptesis ferruginea, n. sp.

Female.—Length 8 mm., antennae 4 mm.

Head in dorsal view about twice as broad as thick; occiput shallowly concave; temples rather weakly convex and moderately sloping; vertex and temples sparsely, shallowly punctate, shining; frons laterally opaque, sha-

greened, medially shining and punctate; ocelli their diameter apart and a little farther removed from eyes; head in front view roundly subquadrate, the mouth very wide; eyes distinctly divergent below; antennae inserted not far above lower tangent of eyes; face opaque, shagreened and coarsely, closely punctate with a sparsely punctate median rounded elevation; clypeus nearly three times as broad as long, with a few coarse punctures medially, its apical margin thin and very broadly truncate, labrum exposed, broadly rounded; mandibles long and stout, lower tooth distinctly the longer; palpi slender; antennae stout, scape obliquely truncate, flagellum thickened toward apex and slightly flattened below, first joint hardly as long as second and hardly a half longer than thick, joints from sixth to those near apex transverse. *Thorax* flattened above and below, subopaque except mesoscutum, scutellum, and speculum, which are shining; pronotum irregularly rugose in impression; mesoscutum sparsely punctate, notauli shortly distinct basally; scutellum polished, with a few punctures; mesopleurum striato-punctate, sternauli deep but incomplete; propodeum precipitous behind, horizontal and vertical faces about equal in length, apical carina of nearly uniform strength throughout, combined basal area and areola constricted before and subangulate behind middle, costulae obsoletely indicated, basal areas partly shining and punctate, otherwise the propodeum is obscurely rugulose and opaque; wings of normal size; radial cell very short; intercubiti slightly convergent above, second distinctly longer than first and almost entirely bullated; nervulus recurved posteriorly; nervellus broken near bottom; legs stout, hind coxae large, closely punctate, especially above. *Abdomen* very finely shagreened and subopaque; first segment broad, the postpetiole nearly square; all other tergites transverse; sheath about as long as first tergite, ovipositor strongly compressed, subsagittate at apex.

Ferruginous, with occiput, stains along thoracic sutures, and petiole black; clypeus and mandibles testaceous; flagellum blackish with a broad white annulus; anterior margin of pronotum and scutellum paler, the latter at apex and postscutellum yellowish; wings hyaline, veins blackish, stigma and costa as well as tegulae stramineous; front and middle coxae and all trochanters stramineous; hind femur more or less piceous within.

Male.—Head more narrowed below, the face, clypeus, and mouth narrower; flagellum tapering toward apex, basal joints longer; thorax more rounded, not so distinctly flattened above and below, more shining; propodeum completely areolated, more strongly rugose behind; abdomen narrower, petiole more slender, postpetiole longer than broad, second tergite as long as broad. Face, frontal orbits, clypeus, mouthparts, lower cheeks, scape below, humeral angle of pronotum, subalar tubercle, tegulae, and front and middle coxae and trochanters yellow. The male is very variable in color, the darkest specimens having the head, except below antennae, and the thorax, except dorsally, piceous to black.

Type locality.—Riverdale, Maryland.

Type.—No. 51057, U. S. National Museum.

Described from 15 females and 13 males, all taken May 18–21, 1934, by H. S. McConnell of the Maryland Agricultural Experiment Station on or near the ground where many hundreds of the larvae of *Tomostethus multicinctus* Rohwer were entering the soil for pupation. Presumably the species is parasitic on the *Tomostethus*.[3]

[3] Since this was written Mr. McConnell has reared the species from cocoons of *Tomostethus*.

Calliephialtes laspeyresiae (Uchida), n. comb.

Ephialtes laspeyresiae Uchida, Insecta Matsumurana, vol. 6: 160, Pl. and fig. 18, 1932.

Dr. Uchida has been kind enough to send me a female specimen (Paratype, No. 51058, U. S. National Museum) of this species. Also there are before me one female and three males reared from *Grapholitha molesta* (Busck) in Japan by G. J. Haeussler of the Bureau of Entomology and Plant Quarantine.

This species and *benefactor* Cushman, an American parasite of the same insect, are very similar, and were it not for the very distinct difference in the male genitalia I would be inclined to consider them as no more than races of the same species. The genital sheath in *benefactor* is unusually long, slender, and strongly exserted, while in *laspeyresiae* it is of normal form. Otherwise the two species structurally are practically identical.

The female of *laspeyresiae* differs from that of *benefactor* in the paler under side of the basal joints of flagellum, the almost entirely pale yellow front and middle coxae, and the possession of a whitish streak on the extensor surface of the hind tibia reaching from the base nearly to the apex.

The male differs from that of *benefactor* in having the under side of the flagellum pale yellowish stramineous except toward the apex, the front and middle legs almost entirely pale, the hind coxae and femora rather broadly pale at the apex, and the dorsal stripe of the hind tibia more conspicuous (sometimes lacking in *benefactor*).

In neither sex does there appear to be any tendency to exhibit red coloration on the thorax, even on the scutellum. However, specimens occur rarely in both sexes of *benefactor* with entirely black thorax.

Lissonota recurvariae, n. sp.

In Cresson's key to the species of *Lampronota* (Trans. Amer. Ent. Soc. **3**: 160, 1870) the female runs to *laevigata* Cresson and the male to *pleuralis* Cresson, from both of which it differs in the white margins of the tergites and in other details.

Female.—Length 4.5 mm., antennae 4.5 mm., ovipositor 5.0 mm.

Head much narrowed behind, temples strongly receding but strongly convex, little more than half as long antero-posteriorly as short diameter of eye; ocellar triangle weakly transverse; ocell-ocular and postocellar lines equal and a little longer than diameter of an ocellus; vertex and temples minutely coriaceous, subpolished; face and frons subopaque, coriaceous; head in front view a little broader than long, eyes about as long as width of face, mostly parallel, but slightly divergent toward lower ends; face prominent medially; clypeus strongly convex and deeply separated from face; malar space nearly as long as basal width of mandible; antennae 30-jointed, very slender filiform with all flagellar joints much longer than thick. *Thorax* slender, rather strongly compressed, twice as long as deep, subopaque coriaceous and minutely punctate, pronotal scrobe and speculum polished; mesoscutum and scutellum distinctly longer than broad; propodeum opaque,

the sculpture very fine and dense with a suggestion of transverse aciculation, with a narrow median groove, transverse carina at apical fourth; legs slender, hind coxa reaching apex of first segment; areolet sessile, nervulus postfurcal, postnervulus broken far below middle, nervellus broken at lower third and inclivous. *Abdomen* slender, subopaque coriaceous, without punctation, the sculpture coarser in the impressions; first tergite fully a half longer than broad at apex; second and third tergites both longer than broad at base, second nearly as long as first; hypopygium hardly reaching apex; ovipositor very slender, sheath slightly longer than body.

Black with the following parts whitish: Apical half or more of clypeus, mouthparts, spots in superior orbits, more or less broken lines on antero-lateral margin of mesoscutum, tegulae, narrow bands at apices of tergites 2–6, interrupted laterally on 4–6, and hypopygium and venter largely; legs ferruginous, front and middle coxae and trochanters more or less whitish, the front ones almost entirely so; hind trochanter piceous, apically and below whitish; hind tibia and tarsus fuscous; wings hyaline, venation brown, stigma paler.

Male.—Essentially like female, but eyes and ocelli larger, ocell-ocular line hardly as long as diameter of an ocellus; antennae 34-jointed; abdomen even more slender, first tergite nearly twice as long as broad at apex.

The following whitish, in addition to the parts so designated for the female: Face, inner orbits and clypeus throughout, cheeks, lower margins and humeral angles of pronotum, notauli, subalar tubercle, a stripe on lower mesepisternum, and apex of seventh tergite. The entire front and middle coxae and trochanters, the apical joint of the hind trochanter, and the apex of the hind coxa are also whitish.

Host.—Recurvaria piceaella Kearfott.

Type locality.—Bristol, Maine.

Type.—No. 51059, U. S. National Museum.

One of each sex reared July 6 (female) and July 3 (male), 1932, under Gipsy Moth Laboratory Nos. 9590e47 and 9390e43.

An abnormal male from the same host at Boothbay, Maine, June 26, 1932, Gipsy Moth Laboratory No. 9590e30, is not included in the type series because of its abnormality.

Genus NELIOPISTHUS Thomson

I have previously[4] discussed the characters, systematic position, and synonymy of this anomalous genus, and the three North American species known at that time. Since that publication I have added a fourth species, and present herewith two additional species, together with a key for distinguishing the six North American species.

KEY TO NORTH AMERICAN SPECIES

1. Face fully twice as long as broad and three-fourths as broad as frons; eyes not longer than width of frons 2
   Face much less than twice as long as broad and not or barely two-thirds as broad as frons; eyes longer than width of frons 5
2. Hind coxae black 3
   Hind coxae red 4

[4] Proc. U. S. Nat. Mus. 56: 379. 1919.

3. Middle coxae largely piceous; joints 11–12 of flagellum white on inner side; ovipositor sheath barely as long as first segment. . . *niger* Cushman
   Middle coxae whitish, only extreme base piceous; flagellum entirely black; ovipositor sheath distinctly longer than first segment. . . . . *longicauda*, new species
4. Malar space nearly half as long as basal width of mandible; intercubitella not or barely as long as abscissula; mesoscutum in female largely or entirely red. . . . . *luggeri* (Ashmead)
   Malar space very short; intercubitella distinctly longer than abscissula; mesoscutum in female entirely black. . . . . *nigridorsum* Cushman
5. Ocelli large, in female much more than half as long as, in male longer than, ocell-ocular line; mesoscutum in both sexes largely red, if at all black this color medial. . . . . *densatus* (Say)
   Ocelli small, in female not or little more than half as long as, in male distinctly shorter than, ocell-ocular line; mesoscutum in female largely black, with center of disk red, in male thorax not at all red. . . . . *piceae*, new species.

Neliopisthus longicauda n. sp.

Very similar to *niger* Cushman, but distinguished at once by its distinctly longer ovipositor sheath, paler middle coxae, and lack of any trace of antennal annulus.

Female.—Length 6.5 mm.; antennae 4.5 mm.; ovipositor sheath 1.3 mm.

Head more than twice as broad as thick, temples strongly convex; ocellar triangle strongly transverse; eyes slightly shorter than greatest width of frons, weakly convergent below; face more than twice as broad as long, medially almost hemispherically elevated; clypeus nearly as long as face; foveo-ocular line fully a third as long as interfoveal line; malar space nearly half as long as basal width of mandible; antennae 30-jointed, basal joint of flagellum about three times as long as thick. *Thorax* hardly twice as long as deep, densely punctate and with dense, short pubescence; areola nearly as broad as long, broadly truncate at base. *Abdomen* broadly ovate, distinctly broader than thorax; first tergite with a strong carina from spiracle to apex, postpetiole with a median longitudinal impression; second tergite much broader at apex than at base; ovipositor sheath distinctly longer than first segment.

Black; center of mesoscutum and scutellum (in type) dark rufous; spot at top of eye, face except medially above, clypeus, malar space, cheeks, mandibles, palpi, upper and lower margin of pronotum and tegulae whitish; wings hyaline; veins black, stigma reddish stramineous, legs ferruginous; front and middle coxae and trochanters whitish, the trochanters behind and middle coxae basally piceous; hind coxa and basal joint of trochanter black femur basally below, tibia basally and apically above, and tarsus infuscate; abdomen black with tergites except first very narrowly pale at apex; venter pale with sternites piceous; sheath black with ventral margin partly whitish.

Type locality.—Lind, Washington.

Type.—No. 51060, U. S. National Museum.

Two females taken May 15, 1922, and May 7, 1923, by M. C. Lane of the Bureau of Entomology and Plant Quarantine.

The paratype is smaller, lacks the red color on the thorax, and has the legs more extensively dark.

Neliopisthus piceae, n. sp.

Similar to *densatus* (Say), from which it is most easily distinguished by the distribution of red on the thorax.

Female.—Length 4.0 mm., antennae 3.5 mm., ovipositor sheath 0.8 mm. *Head* half as thick as broad, temples strongly convex; ocellar triangle not very strongly transverse; diameter of an ocellus about half as long as ocell-ocular line; eyes strongly convergent below, longer than width of frons; face nearly as long as its least width, medially somewhat elevated; clypeus much shorter than face; foveo-ocular line and malar space much reduced; antennae very slender filiform, first flagellar joint fully four times as long as thick. *Thorax* very nearly as long as deep, densely punctate; areola much longer than broad, narrowly truncate at base. *Abdomen* rather narrow, hardly broader than thorax; first tergite without carinae from spiracle to apex, postpetiole without median impression; second tergite nearly as long as first, its sides weakly divergent; ovipositor sheath distinctly longer than first tergite.

Black, center of mesoscutum, scutellum, mesopleurum, and metapleurum more or less rufous; spot at top of eye, face, clypeus, malar space, cheeks, mandibles, palpi, scape and pedicel below, upper and lower margins of pronotum, and tegulae whitish; legs ferruginous, front and middle coxae and trochanters whitish; basal joint of hind trochanter piceous at base, whitish at apex; tibia basally and apically above and tarsus infuscate; wings hyaline, veins blackish, stigma stramineous; abdomen black, tergites beyond first broadly ferruginous laterally and narrowly pale apically; venter whitish with sternites piceous; sheath black, its lower margin partly white.

Male.—Eyes parallel below antennae; foveo-ocular line and malar space each about half as long as basal width of mandible; diameter of an ocellus nearly as long as ocell-ocular line; areola fully twice as long as broad; abdomen distinctly narrower than thorax. Black without ferruginous, at most the abdomen piceous laterally; hind coxae more or less piceous above.

Host.—*Recurvaria piceaella* Kearfott.

Type locality.—Southport, Maine.

Type.—No. 51061, U. S. National Museum.

Two series of specimens, the first (two females and one male), including the type and allotype, reared from the host under Gipsy Moth Laboratory Nos. 12467 and 9590 at Southport and Bristol, Maine; the second (three females and two males) received from Stanley Garthside, who collected them in Itasca State Park, Minnesota, in September 1927.

The Minnesota specimens are larger, with the red color and the pale margins of the tergites brighter. One of the females in the latter series is headless.

Oocenteter, n. gen.

Head in dorsal view transverse, the temples nearly as broad as eyes and very strongly convex; in front view broadly transversely oval; eyes strongly convergent below; clypeus deeply separated, convex, broadly rounded at apex; malar space nearly obliterated; mandibles stout, strongly convex basally, lower tooth the longer; palpi very short and stout; ocelli in a strongly transverse triangle; occipital carina somewhat more sharply curved

medially than elsewhere, meeting hypostomal carina shortly behind base of mandible; antennae in female a little longer than head and thorax, stout and slightly tapering toward apex, in male somewhat longer and more slender, scape almost squarely truncate at apex. *Thorax* stout ovoid; epomia lacking; notauli weak; scutellum strongly convex, medially higher than mesoscutum, immargined laterally, fovea very deep, smooth; postscutellum with a deep, undivided fovea at base; sternauli weakly impressed anteriorly; mesolcus very deep, not closed behind; metapleurum nearly as high as long, strongly convex; propodeum very short, carinae very high, especially the apical carina, costulae lacking, basal area and areola nearly equal in size and triangular, spiracles circular and situated on a small elevation; wing veins heavy; stigma rather broad with radius at middle; radial cell short, barely as long on metacarpus as stigma; basal vein meeting medius at a slightly acute angle; areolet elongate, oblique with recurrent nearly at its apex; discocubitus strongly curved basally; recurrent nearly straight, the bullae not or weakly separated; nervulus postfurcal and strongly inclivous; postnervulus broken far below middle; nervellus strongly inclivous and broken far below middle; legs, especially front femur, rather stout; tibiae and tarsi conspicuously spinose; calcaria very short; claws simple. *Abdomen* broadly fusiform; first segment subtriangular, about as broad as long in female, a little narrowed in male, sides nearly straight, lateral carinae complete to apex, dorsal carinae to middle, basal lateral foveae very deep; hypopygium rather prominent though not reaching apex of abdomen; sheath short and rather broad, barely surpassing apex of abdomen, ovipositor very slender and slightly upcurved.

Type of genus.—*Oocenteter tomostethi*, new species.

The natural position for this genus is somewhat obscure. The lack of epomia, the open mesolcus, and the entire lack of costulae would seem to exclude it from the Tryphonini, to which in general form and in the distinct dorsal carinae of the first tergite it seems most closely allied. Moreover, the structure of the ovipositor and the habit of internal parasitism definitely exclude it from that tribe. In the Mesoleptini most of its characters would place it in the subtribe Mesoleiina, where it runs best to *Hypsantyx*, though not with entire satisfaction. To me it seems most closely related to *Trematopygus*, though it differs markedly from that genus in its deeply separated clypeus, convergent eyes, and very short ovipositor sheath. In most other respects it is similar to *Trematopygus*. Neither of these genera belongs, I believe, to the Perilissina, but rather to the Catoglyptina, where the gap between them and the more typical genera is partly bridged by *Provancherella* Dalla Toree. To this subtribe I would also relegate *Lethades* Davis and *Zaplethocornia* Schmiedeknecht.

The generic name refers to the habit of ovipositing in the egg of the host whereas the larva feeds within the host larva.

Oocenteter tomostethi, n. sp. Fig. 1

Female.—Length 5.5–7.0 mm.

Head densely, finely punctate, sparsest on temples and densest on face, with dense short silvery pubescence; temples nearly as long antero-posteri-

orly as short diameter of eye; diameter of an ocellus much shorter than ocellocular line and hardly half as long as postocellar line; convergence of eyes as 3 to 2; clypeus shining, sparsely and rather coarsely punctate, nearly twice as broad as long; antennae longer than head and thorax by the length of its apical 7 or 8 joints, 28- to 30-jointed, first joint of flagellum slightly more than twice as long as thick at apex and about a half longer than second joint, joints beyond middle transverse. *Thorax* conspicuously pubescent, especially laterally, shining, finely punctate, with speculum polished and impunctate, mesoscutum and scutellum subpolished and less densely punctate, and apical areas of propodeum irregularly roughened. *Abdomen* subopaque and densely, finely punctate, subpolished toward apex.

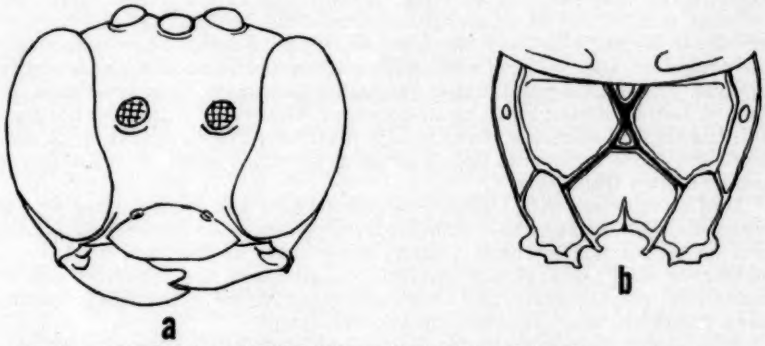


Fig. 1.—*Oocenteter tomostethi* Cushman. *a*, head, front view; *b*, propodeum.

Head and thorax black; clypeus ferruginous, darker toward base; mandibles yellowish; palpi pale reddish; scape ferruginous, flagellum pale yellowish ferruginous; legs ferruginous, hind tibia slightly darkened above; wings hyaline, venation black with base of stigma and costa yellow, tegulae and a small humeral spot reddish. Abdomen ferruginous, more or less darkened at apex, especially laterally and ventrally, the last three ventral segments and sternites of others piceous, membrane yellow.

Male.—Eyes less strongly convergent; antennae longer and more slender, 33-jointed, none of the joints transverse; abdomen narrower, first segment somewhat blackened basally; otherwise essentially like female.

Host.—*Tomostethus multicinctus* Rohwer.

Type locality.—Riverdale, Maryland.

Type.—No. 51062, U. S. National Museum.

Described from the following material: Three females and four males (type and allotype) reared April 29, 1935, by H. S. McConnell of the Maryland Agricultural Experiment Station from cocoons of the host collected at the type locality; three females and five males extracted September 22, 1934, from cocoons of the host at College Park, Maryland, by Mr. McConnell; 29 females captured in the act of ovipositing in the eggs of the host on May 4, 1934, at Riverdale by Mr. McConnell; and two females reared from the same host at Boston, Mass., on May 14, 1925, under Gipsy Moth Laboratory No. 12164K17b.

Perilissus tomostethi, n. sp.

Female.—Length 7 mm., antennae 8 mm.

Body opaque, shagreened, with only speculum polished and face, mesoscutum, mesopleurum, and basal tergites obscurely punctate.

Head a little more than half as thick as broad, temples broad and strongly convex; eyes and ocelli small, ocell-ocular line nearly twice the diameter of an ocellus and malar space two-thirds basal width of mandible; eyes slightly divergent below, not emarginate; clypeus not separated from face, but there is a broad shallow transverse concavity involving lower part of face and base of clypeus; clypeus broadly truncate, its margin thick and bearing coarse setiferous punctures; lower tooth of mandible larger and longer than upper tooth; flagellum slender filiform, all joints longer than thick, first joint about three times as long as thick. Notauli faintly impressed; scutellum strongly convex, not at all margined; propodeum without defined basal or middle areas but with three sharply-defined apical areas, which are irregularly rugulose; stigma large, with radius slightly before middle; areolet large, oblique, recurrent beyond middle; nervulus postfurcal; nervellus inclivous, broken below middle; legs long and slender, hind inner calcarium hardly a third as long as basitarsus, claws weakly pectinate. First tergite subpetiolate, less than twice as long as broad at apex, glymmae large, translucent; all other tergites transverse.

Dull ferruginous with occiput, middle of face and frons, upper side of scape and base of flagellum, thoracic sutures, stains on mesothoracic lobes and on pleura and sternum, petiole, coxae more or less, and hind femur piceous to black; sides of face and frons, malar space, and scutellum yellow; mandibles, palpi, tegulae, and wing-bases stramineous; hind tibia infuscate, tarsi yellowish; wings hyaline, venation blackish.

Male.—Structurally much like female but more slender, head larger, eyes smaller, and propodeum with areola defined laterally.

Head yellow with only occiput and middle of vertex and frons black; scape and pedicel below yellow; thorax black, with humeral angle and lower margin of pronotum, mark on lateral margin of mesoscutum, scutellum, irregular stripe below on mesopleurum connected with one across prepectus, and subalar tubercle yellow; mesoscutum sometimes partly ferruginous; front and middle coxae and trochanters and hind coxa and trochanter below yellow, hind coxa and trochanter otherwise black; hind femur black only within; first tergite largely black.

Host.—*Tomostethus multicinctus* Rohwer.

Type locality.—Boston, Mass.

Type.—No. 51063, U. S. National Museum.

Two females and one male reared from the host May 28 to June 1, 1928, under Gipsy Moth Laboratory No. 12164K17b.

Genus Phaedroctonus Foerster

As generic characters go in the Campoplegini, the lack of the areolet and the broad, nearly right-angled radial cell of this genus together with the somewhat different facies seem to be sufficient ground for separating it from *Nemeritis* Holmgren. I therefore, do not follow Viereck[5] in synonymizing *Phaedroctonus* with *Nemeritis*. Some, if not all, of the American species as-

[5] Can. Ent. 57: 201. 1925.

signed by Viereck to *Nemeritis* should be transferred to *Phaedroctonus*. The genus seems to be associated rather definitely with coniferous trees.

The three new species which are described below are congeneric with the species *Phaedroctonus transfugus* (Gravenhorst), *argyresthiae* Rohwer, *minutus* Ashmead, and **(Limneria) Phaedroctonus cupressi** (Ashmead), (new combination), and also, apparently, with the new species described by Viereck in the work cited.

Phaedroctonus epinotiae, n. sp.

In Viereck's key to North American species of *Nemeritis* (loc. cit., p. 178) this will run directly to *cupressi* (Ashmead) and agrees with all the key characters leading to that species. From the type of *cupressi* it is immediately distinguishable by its much more strongly receding temples, broader abdomen, and shorter ovipositor sheath.

Female.—Length 4.0 mm, antennae 3.0 mm, ovipositor sheath 0.8 mm.

Head granularly opaque, in dorsal view transversely ovate, occiput rather deeply concave, temples strongly receding and only moderately convex; diameter of an ocellus and postocellar and ocell-ocular lines subequal, the first sometimes slightly the shortest; eyes distinctly convergent below; face slightly broader above than length of combined face and clypeus; clypeus convex, rather strongly rounded at apex and separated from face by an arched impression; malar space distinctly more than half as long as basal width of mandible; antennae 25- to 27-jointed (26-jointed in holotype), barely three-fourths as long as body. *Thorax* much more than twice as long as broad, the propodeum sloping gently from near base and overlapping more than the basal third of hind coxa; thorax generally finely granularly opaque with only speculum polished, with distinct punctation, the propodeum minutely shagreened; basal area very narrow and nearly parallel-sided, areola much longer than broad, acutely angled at base, longitudinal carinae beyond basal and the costulae obsolescent or absent; wings and legs normal for the genus. *Abdomen* opaque granulate, very weakly compressed apically; second tergite as long as first and fully three times as long as broad at base, spiracles distinctly but not far beyond middle; third tergite as long as broad at base; sheath only slightly longer than first segment.

Black; mandibles, palpi, scape and pedicel beneath, and tegulae yellow; wings hyaline, venation blackish; front and middle coxae piceous at base, their apices and their trochanters yellow, their femora and tibiae pale ferruginous, the tibiae above and their tarsi stramineous, the tarsus fuscous apically; hind coxa black, basal joint of trochanters piceous, apical joint yellow, femur rufo-piceous, tibiae fuscous, slightly paler at base and in middle, calcaria white, tarsus fuscous; abdomen black, the compressed portion yellowish ferruginous below, plica yellow.

Male.—Essentially like female; antennae nearly as long as body; malar space barely half as long as basal width of mandible; front and middle coxae largely yellow.

Host.—Epinotia nanana Treitschke.

Type locality.—Bristol, Maine.

Type.—No. 51064, U. S. National Museum.

Seven females and 13 males reared from the type-host under Gipsy Moth Laboratory No. 9590, mostly from the type locality, two males from Harps-

well, Maine, and one male from Georgetown, Maine; also one of each sex labelled "ex leaf-miner on *Picea*" under Gipsy Moth Laboratory No. 12467, the female from Southport, Maine, and the male from the type locality.

Phaedroctonus temporalis. n. sp.

Like *epinotiae* this species runs best in Viereck's key to *cupressi* (Ashmead), but has the temples broader and the ovipositor longer. From the above description of *epinotiae* it differs principally as follows:

Female.—Length 5 mm., antennae 3.5 mm., ovipositor sheath 1.5 mm.

Head in dorsal view transversely oblong, temples extending straight backward and continuous with outside tangent of eye, occiput less strongly concave; postocellar line distinctly longer than ocell-ocular line, the latter not or barely as long as diameter of ocellus; eyes virtually parallel; clypeus nearly flat, not separated from face, apex nearly transverse; malar space barely longer than basal width of mandible; antennae 28-jointed; longitudinal carinae of propodeum distinct, parallel; abdomen more distinctly compressed; ovipositor sheath more than one and a half times as long as first segment.

Front and middle coxae more extensively black, the middle coxa entirely so above and reddish brown below; basal joint of middle trochanter somewhat darkened basally; front and middle tarsi infuscate; compressed portion of abdomen not pale below.

Host.—*Laspeyresia youngana* Kearfott.

Type locality.—Groton, Vermont.

Type.—No. 51065, U. S. National Museum.

Two females reared August 15, 1927, under Gipsy Moth Laboratory No. 12164M255a, from infested cones of red spruce.

Phaedroctonus piceae, n. sp.

Runs in Viereck's key to *laevis* Viereck, but is apparently distinct from that species in its entirely black front coxae, darker tarsi, uniformly dark hind femur, and entirely black tergites.

Differs from above description of *epinotiae* as follows:

Female.—Length 4 mm., antennae 2.5 mm., ovipositor sheath 1 mm.

Head in dorsal view with temples strongly convex and weakly receding, occiput less strongly concave; postocellar line evidently longer than ocell-ocular line or diameter of ocellus, the latter two subequal; eyes virtually parallel; clypeus weakly convex, not separated from face, weakly rounded at apex; antennae 23- to 24-jointed (24-jointed in holotype), less than three-fourths as long as body; thorax but little more than twice as long as broad, propodeum sloping convexly and abruptly and not reaching to basal third of hind coxae; areola hardly longer than broad, distinctly defined laterally, costulae distinct, petiolar area slightly concave and rugulose; second tergite distinctly shorter than first and distinctly less than three times as long as broad at base, third tergite distinctly broader at base than long; sheath about a half longer than first segment.

Scape and pedicel and all coxae entirely black; hind tibia alternately annulated with whitish and black, middle tibia whitish above, stramineous below; hind tarsus fuscous with base of basitarsus whitish; tergites entirely black.

Male.—Essentially like female; antennae longer, malar space slightly shorter, front and middle coxae pale apically.

Hosts.—*Recurvaria piceaella* Kearfott (type); *Epinotia nanana* Treitschke.
Type locality.—Georgetown, Maine.
Type.—No. 51066, U. S. National Museum.

Two females reared from the type host under Gipsy Moth Laboratory No. 9590 from North Andover, Mass. (type) and Georgetown, Maine; one female from *Epinotia nanana* at Ocean Point, Maine, under Gipsy Moth Laboratory No. 12467; and one male reared from the type-host at Harpswell, Maine, under Gipsy Moth Laboratory No. 9590; all during the last week of June.

Cremastus grapholithae, n. sp.

Very distinct from all previously described North American species in its very long propodeal areola, the posterior margin of which is nearly or quite interstitial with the lateral portions of the apical carina.

Female.—Length 7.5 mm., antennae 4.0 mm., ovipositor sheath 2.5 mm.

Head finely shagreened all over, a little more than twice as broad as thick, temples short, strongly receding and weakly convex; diameter of an ocellus nearly or quite as long as postocellar line and distinctly longer than ocellocular line; head in front view distinctly transversely oval; face impressed and minutely punctate on each side of middle, distinctly broader than combined length of face and clypeus; eyes as long as width of face, parallel or very weakly divergent below; clypeus somewhat more than half as long as interfoveal line, inflexed and very broadly rounded at apex; malar space hardly two-thirds as long as basal width of mandible; antennae 29- to 32-jointed. *Thorax* hardly twice as long as deep, finely shagreened, with mesoscutum, scutellum, mesopleurum and sternum shallowly punctate, propodeum medially and apically more or less transversely rugulose; speculum polished; notauli very weakly defined anteriorly; scutellum weakly convex; propodeum extending well beyond middle of hind coxae, areola more than twice as long as broad, its posterior margin nearly or quite interstitial with lateral portions of apical carina; stigma rather broad, with radius distinctly beyond middle, nearly as long as radial cell measured on metacarpus; postnervulus broken above middle; nervellus broken at or a little below middle; hind legs rather stout, tibia as deep apically as femur, inner calcarium about a third as long as basitarsus. *Abdomen* slender; first tergite entirely without lateral carinae, its lateral margins nearly meeting ventrally; second tergite a little more than four times as long as broad at base; compressed portion three times as long as deep, third tergite slightly less deep than fourth; second tergite obscurely longitudinally striate, others shagreened; sheath twice as long as first segment.

Black, ferruginous, and yellow; head yellow with stemmaticum and occiput black, the space between and middle of frons black to brownish ferruginous; antennae black, scape and pedicel yellow in front, flagellum more or less reddish below, especially at apices of joints; thorax ferruginous with pronotum medially, prescutum (usually), lateral areas of scutellum and postscutellum, propodeum medially, metasternum, and sometimes mesosternum black; propleura, upper and lower margins of pronotum, humeral margins of mesoscutum and notauli, scutellum except apex, tegulae, subalar tubercle, and an oblique band on mesopleurum yellow; wings hyaline, venation brownish, marginal half of stigma and metacarpus pale; front and middle legs pale ferruginous, coxae and trochanters pale yellowish, tibiae with a pale stripe on extensor surface; hind coxa and trochanter yellowish, basal joint of trochanter more or less marked with piceous, femur

piceous with distinct stripes of yellow on dorsal, ventral, and inner surfaces, tibia infuscate at base and apex, yellowish in middle and with a distinct yellow stripe on extensor surface, tarsus fuscous, paler below and at bases of joints; abdomen black, apices of tergites narrowly but indefinitely reddish, lower half or third of compressed portion pale yellow, epipleura yellowish hyaline, venter yellow.

Male.—Eyes and ocelli large, malar space and ocell-ocular line much reduced, diameter of lateral ocellus as long as or longer than postocellar line and several times as long as ocell-ocular line; eyes much longer than width of face, the latter hardly broader than combined length of face and clypeus; second tergite five times as long as broad at base.

Head and thorax colored as in female, but frons not black medially and pronotum not at all ferruginous; abdomen not at all yellow but tergites 3–5 each with a broad apical band of ferruginous, broader laterally, tergites 6 and 7 broadly yellowish ferruginous laterally.

Host.—*Grapholitha molesta* (Busck).

Type locality.—Harriman, Tennessee.

Type.—No. 51067, U. S. National Museum.

Described from fifteen specimens of each sex selected from more than twice that number and reared from the type host at field stations of the Bureau of Entomology. Seven females and 12 males, including the type and allotype, are from the type locality; one female from Kingston, Tennessee; one female from Cornelia, Georgia; one female from Raleigh, North Carolina; four females and two males from Berlin, Maryland; and one of each sex from Moorestown, New Jersey.

In one of the Harriman specimens the thorax is black only in the scutellar region.

In the additional material are specimens from Fairfax, Virginia, and Clemson College, South Carolina. Another lot not included in the type series was reared from *Acrobasis caryae* Grote at Brownwood, Texas, under Quaintance Nos. 27894, 27896, 27906, 27926, and 27929; while a single specimen from the Agricultural and Mechanical College, Mississippi, was reared from *Laspeyresia caryana* (Fitch).

Cremastus chilonis, n. sp.

Reminiscent, in its very dense short thoracic vestiture and long narrow areola, of the genus *Pseuderipternus* Viereck.

Female.—Length 9 mm., antennae 6 mm., ovipositor sheath 3.5 mm.

Head rather thick, barely twice as broad as thick, temples strongly convex but narrow, occiput rather deeply concave; eyes divergent below; face slightly wider at top than length of eye, opaque coriaceous and more or less distinctly punctate; frons and temples coriaceous; clypeus more than half as long as broad, broadly arcuate at apex; malar space subequal to basal width of mandible. *Thorax* opaque and with very dense, short, silvery pubescence; notauli rather deeply and sharply impressed; scutellum rather flat but not distinctly margined; propodeum extending a little beyond middle of coxae, densely and rather coarsely punctate, apical areas transversely rugulose, carinae unusually high, areola much longer than petiolar area and strongly separated from it; stigma narrow with radius at middle;

radial cell narrow, much longer on metacarpus than stigma. *Abdomen* stout, strongly compressed only apically, coriaceous, postpetiole and second tergite partly longitudinally striate, others sparsely punctate; first tergite with its lateral margins approximate and nearly enclosing the sternite, petiole deeply grooved laterally; second tergite barely twice as long as broad at base, hardly as long as first.

Ferruginous with head more yellowish and with the following black or blackish markings: Occiput, middle of vertex and frons, lobes of mesoscutum largely, mesosternum, propodeum partly to entirely, stains along all thoracic sutures, tergites 1 and 2 except apices, other tergites in basal middle; antennae, palpi, tegulae, and tarsi black or blackish, as are also the base and apex of each tibia, the hind femur at apex, and the hind trochanter; wings hyaline, venation blackish, stigma dark stramineous.

Male.—Essentially like female but ocelli larger in diameter, this being nearly as long as ocell-ocular line; abdomen narrower, the second tergite about two and a half times as long as broad at base. Black color more extensive.

Host.—*Chilo forbesellus* Fernald.

Type locality.—Douglas Lake, Cheboygan County, Michigan.

Type.—No. 51068, U. S. National Museum.

Three females and three males from the type locality and two males labeled merely Cheboygan Co., all reared from larvae of the host during July and August 1934 by Paul S. Welch of the University of Michigan.

Cremastus protractus, n. sp.

Because of the unusually long posterior extension of the propodeum and the very long, slender, and blade-like abdomen this might be considered to represent a new genus, but since those portions of the body are subject to a considerable degree of variation within the present genus it seems wisest to place it here, at least for the present.

Female.—Length 10 mm., antenna 3.5 mm., ovipositor sheath 3.5 mm.

Head thin, more than twice as broad as thick, temples very narrow, moderately convex, occiput shallowly concave; ocelli small, diameter much shorter than ocell-ocular line; head in front view subtriangular, slightly broader than long; eyes parallel; face much broader than length of eye, coriaceous, subopaque with scattered minute punctures; frons coriaceous, rugulose in the scrobes and with a weak median carina below; clypeal suture at about level of lower eye margin; clypeus nearly twice as broad as long, apex nearly straight; malar space fully as long as basal width of mandible, which is only a little longer than broad; width of mouth (i.e., distance between bases of mandibles) distinctly less than that of face. *Thorax* slender, compressed, coriaceously opaque and evenly punctate, with propodeal "neck" extending slightly beyond apex of hind coxa; notauli broadly impressed; scutellum nearly flat, subcarinately margined nearly to apex; propodeum basally coriaceous with scattered punctures, transversely rugulose behind basal carina and laterally, areola and petiolar area confluent; wings, because of the great length of body, appearing very short; stigma broad with radius at middle; radial cell very short, hardly longer on metacarpus than stigma; legs rather short, hind femur reaching only a little beyond apex of first segment. *Abdomen* fully three times as long as thorax, very slender, blade-like, compressed from base of third tergite, this portion many times as long as deep, tergites beyond sixth concealed; first tergite with its lateral margins parallel, not enclosing the sternite, petiole with a deep furrow on

each side nearly the entire length; second tergite distinctly longer than first, about six times as long as broad at base, weakly longitudinally striate, its spiracles slightly beyond middle; compressed portion shagreened, with sparse punctation, tergites 3–6 each deeply incised at apical middle.

Black; apex of clypeus and mandible yellowish red; wings hyaline, venation blackish, tegulae and radices yellow; legs ferruginous, hind coxae toward base, hind tibia above, and tarsi blackish; venter yellowish with dark sternites.

Host.—*Coleophora* sp. on *Aster eatoni*.

Type locality.—Pullman, Washington.

Type.—No. 51069, U. S. National Museum.

One specimen reared July 16, 1933, by J. F. Gates Clarke of the Washington State College of Agriculture.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

GEOLOGICAL SOCIETY

526TH MEETING

The 526th meeting was held in the Assembly Hall of the Cosmos Club, March 13, 1935, President SCHALLER presiding.

Informal communications.—G. W. STOSE and ANNA I. JONAS: *Limestones of Frederick Valley, Maryland.* The Frederick Valley of Maryland is a limestone valley east of the Blue Ridge-Catoctin Mountain uplift, and therefore in the Piedmont belt. The limestone is locally exposed from beneath the cover of Triassic rocks which have been dropped down about 3,000 feet by a normal fault along the east foot of Catoctin Mountain. A few fossils of Ordovician age were collected from the limestone by Keyes as early as 1890. Fossils collected later from the Le Gore quarry were first regarded as Beekmantown but are now assigned to the Upper Ozarkian by Ulrich and Foerste. Bassler in 1919 separated the limestones of the Frederick Valley into two formations. He called the pure thick-bedded quarry rock Beekmantown limestone on the basis of the fossils found at the Le Gore quarry, and the thin-bedded slabby somewhat fossiliferous limestone Frederick limestone, and determined its age to be probably Chazy. He considered the Frederick to lie unconformably on the Beekmantown. Later Miss Jonas in re-mapping the limestones during a survey of Frederick County for the Maryland Survey found highly quartzose limestone everywhere present in the supposed Beekmantown at the contact with the Frederick, which threw doubt on the unconformable relations. Recent structural study by Miss Jonas and Mr. Stose established the fact that the thick-bedded quarry rock is in synclines in the Frederick limestones and not in anticlines, as interpreted by Bassler. This structural interpretation conflicts with the fossil evidence as applied by Bassler. It was found that the confusion arose from correlating the pure quarry rock throughout the valley, which is generally unfossiliferous, with the quarry rock containing the Ozarkian (formerly Beekmantown) fossils in the Le Gore quarry. These fossils occur only in the north wall of the quarry and a vertical normal east-west fault passing through the quarry separates it from other pure limestone in the south wall of the quarry, which carries a fauna very similar to that in the underlying Frederick limestone. It was found that the Ozarkian is restricted to the small triangular area at

the north edge of the limestone valley, and the main body of pure limestone in the center of the Frederick Valley is probably of Chazy or later age and conformably overlies the Frederick limestone. The limestone of Ozarkian age is named Le Gore limestone, and the main quarry rock overlying the Frederick is named Grove limestone.

The Frederick limestone is correlated with the lower part of the Conestoga limestone, Pennsylvania, on the basis of its fossils, chiefly *Strophomena stosei*. The Conestoga limestone occupies a wider area than the Frederick. Well exposed outcrops of the unconformity at its base occur near Lancaster where it overlies Lower Cambrian limestone. Elsewhere it is unconformable on rocks ranging from Beekmantown limestone to Harpers phyllite. Frederick limestone on the east side of Frederick Valley unconformably overlies Antietam quartzite in which are found trilobite fragments. East of the Le Gore quarry Frederick limestone overlies Le Gore (Ozarkian) limestone and the steeply dipping intervening rocks are covered by the Frederick which was deposited on their upturned and eroded surface. West of the Valley, the Frederick limestone similarly overlies Antietam quartzite and Harpers phyllite in the down-dropped block between the Triassic rocks and Catoctin Mountain. Discussed by Messrs. GILLULY, MERTIE, RESSER.

J. S. WILLIAMS exhibited a piece of the living chamber of a large Pennsylvanian nautiloid cephalopod from Texas. The specimen came from the upper part of the Graham Formation near Graham, Texas. It is thought to represent a part of a coiled cephalopod larger than any previously known from rocks of this age in the United States. The specimen is not complete enough even for generic determination. Discussed by Messrs. SCHALLER, FOERSTE.

Program.—C. E. RESSER: *The Beltian system.* Discussed by Messrs. GILLULY, MERTIE, Miss JONAS.

CHARLES MILTON: *Metamorphism of a granitic dike at Franklin, New Jersey.* A few hundred feet to the south of the zinc ore-body at Franklin, N. J., is an exposure, some hundred feet square, of a rock which has been variously interpreted as sandstone, trap, quartzite, and conglomerate. Evidence is presented that it is a metamorphosed quartz-microcline dike, of which numerous unaltered examples exist in the vicinity. Albite depositing solutions have formed a fine-grained albite-quartz aggregate, in place of the granitic quartz microcline rock. Chemical and microscopic characters of the different rock types constituting the occurrence are discussed. The metamorphism, it is suggested, may be due to solutions emanating from the nearby minette which from observed geological relations intersects the granitic dike underground. (*Author's abstract.*) Discussed by Mr. A. C. SPENCER.

D. F. HEWETT: *Manganese oxides and the circulation of ground water.* During recent years, with the increase in the study of ground water problems, it has become widely thought that, unless water is confined in an aquifer, it moves very slowly below the level of ground water, and that particles of water move in a rather direct path from the point of intake to that of outlet. This is in contrast to an earlier belief that particles of water move in highly circuitous routes from intake to outlet.

The common hydrous and anhydrous oxides of manganese, wad, psilomelane, manganite and pyrolusite are deposited where solutions carrying manganese in low states of oxidation encounter free oxygen, generally derived from the surface. In many parts of the United States in recent years, the common manganese oxides have been found below present levels of

ground water. If, in these regions, there is good evidence that the water levels have not changed greatly, the possibility is raised that oxygen-bearing surface water has circulated below the water table.

Recent explorations on manganese deposits in Virginia have revealed these oxides of manganese, not only 100 to 200 feet below the local water level but 50 to 100 feet below the nearby major streams. A good example is the Niesswaner shaft of the Kendall and Flick mine near Elkton in the Shenandoah Valley, but the best is a recent shaft at the Leets mine, 7 miles east of Lynchburg, Campbell County, which lies in the Piedmont region. The shaft is located on a hillside 300 feet west of a fork of Beaver Creek and 100 feet higher and was sunk to 300 feet or 200 feet below the stream. Water first stood 80 feet below the collar of the shaft, and a heavy flow of water was pumped all of the way to the bottom. Several hundred tons of high-grade manganese oxides were mined from a 50-foot winze below the 200 level in addition to several thousand tons mined years ago above that level. In December, 1934, there were 150 feet of drifts on the 300 level and nodules of psilomelane were abundant in four vertical zones of soft clays and sands formed by the decomposition of the enclosing shaly sandstone. These rocks are now interpreted as part of the Wissakickon schist which, with the nearby Cockeysville marble, is regarded as Pre-Cambrian. They strike northeast and dip nearly vertically.

So far as the writer is aware, no one has proposed that the Piedmont region nearby has been raised above its present elevation, and there is much physiographic evidence against the idea. James River, 2 miles northwest, flows on hard rocks, and low water level is about 50 feet above the 300 level of the mine. It seems, therefore, that surface waters have circulated freely and deposited manganese oxides at least 220 feet below the local water level, 200 feet below a nearby stream and 50 feet below a master stream 2 miles distant. These relations indicate that the surface water circulates freely at least 200 feet below local ground water level. (*Author's abstract.*) Discussed by Messrs. JOHNSTON, WELLS, LASKY, TRASK, SCHALLER, GILLULY, KRAMER, LEGGETTE, MEINZER, SPENCER.

527TH MEETING

The 527th meeting was held in the Assembly Hall of the Cosmos Club, March 27, 1935, President SCHALLER presiding.

Informal communications.—ANNA I. JONAS reported the finding of fossil fish bones, scales and plant remains in the Triassic rocks of the Potomac area in Fauquier County, Virginia. The locality is at Antioch, on the old Warrenton quadrangle, 3 miles north of Thorofare Gap on a county road which leads west through Bull Run Mountain to The Plains and only one-half mile east of the western border fault of the Triassic rocks. The fossils occur in westward-dipping black carbonaceous shales in the upper member of the Triassic sediments, the Gettysburg shale locally called Bull Run shale. They are in large part soft red shales and red sandstone with thin beds of olive or black shales. Fossil wood, plant remains, and fish scales have been found in the lower member of the Triassic in the other areas of Virginia, largely in the Richmond and Farmville basins. The Potomac area previously has yielded only plant remains from near Manassas where they occur in the lower sandstone member. The fossils collected at Antioch have not been determined. From what was seen at the locality it appeared to be a good collecting ground and may contain other forms than those mentioned. Also search in the

vicinity might reveal other fossil-bearing outcrops of the same or other horizons.

L. W. CURRIER reported the results of a statistical study of the subjects presented before the Society for the five-year period ending March 27, 1935. Of the 148 papers, 35 were devoted to areal, physiographic, and glacial studies, 32 to stratigraphy, sedimentation and paleontology, 24 structural, 18 to petrology, mineralogy, and metamorphism, 14 to geophysics, isostasy, seismology, 13 ore deposits, 2 nonmetallic deposits, and 10 unclassifiable.

Program.—M. M. KNECHTEL and H. E. ROTHROCK: *Evidence of recent crustal movement at the west end of the Ouachita Mountains, Oklahoma.* Three thick competent sandstone beds, separated by several hundred feet of shales of the Pennsylvanian Atoka formation (Pottsville), form a ridge about 70 feet high in the western part of the town of Atoka, at the western end of the Ouachita Mountains in southeastern Oklahoma. The ridge trends about N. 20° E., parallel to the strike of the steeply westward-dipping rocks and approximately parallel to the traces of the Choctaw thrust fault, located less than a mile to the east, and of several minor faults in the vicinity of Atoka.

Water mains and sewer pipes, installed since 1906 and buried in trenches along six parallel streets which cross the east side of the ridge at right angles to its trend have been broken repeatedly at points where they pass through the lowermost sandstone bed, which is about 55 feet thick. All of these points lie nearly in a straight line and extend a distance of 2,000 feet along the ridge. The tile sewer pipe near the corner of A Street and Montana Avenue had been subject to stoppage for several years before it was uncovered in June, 1933, when it was found to be broken with a horizontal offset at right angles to its longitudinal axis, the portion east of the break being offset N. 20° E. relative to the portion west of the break. The displacement was horizontal only and amounted to 4 inches.

It is believed that these phenomena are caused by movement along a fault because of (1) actual horizontal offsetting of the sewer pipe along A Street, (2) alinement of all points of pipe failure, (3) parallelism of the direction of movement and alinement of pipe failures with the traces of several faults in the neighborhood. The movement is believed to be slow and more or less continuous rather than intermittent because earthquake shocks have not been felt in the neighborhood and because ruptures in all the water mains and sewers affected do not happen simultaneously, but generally occur singly and at different times.

The distortion and cracking of the foundations of several buildings on the ridge and the necessity for frequent readjustment of door and window frames in these houses may be related to the same disturbance. Buildings in other parts of the town are relatively free from such troubles, though the quality of their construction appears to be no better than that of the buildings on the ridge. The breaks in water mains could not have been caused by freezing because in this region frost penetrates only a few inches below the surface, whereas the mains are buried under several feet of soil. Hillside creep of the shale beds on the east side of the ridge cannot account for the direction of the movement, which is horizontal and parallel to the axis of the ridge, and the maximum grade of about 6°, on the shale slope is believed to be insufficient to cause motion in the shale and a slumping of the overlying steeply tilted thick competent sandstone bed along which the pipe failures have taken place.

The Texas-Oklahoma earthquake of April 11, 1934, which was felt at

Hugo, Okla., 35 miles southeast of Atoka, is regarded by E. H. Sellards as due to movements on old faults in the Balcones fault zone. These movements and the movement at Atoka may be indicative of widespread crustal instability at the present time in the Ouachita belt. (*Authors' abstract.*) Discussed by Messrs. STOSE, MILTON, FERGUSON.

D. A. ANDREWS: *Early stages of glacial Lake Souris, North Dakota.* Glacial Lake Souris, of late Wisconsin age, lying within the present drainage basin of Souris River in north-central North Dakota, was briefly described in 1895 by Warren Upham, who described in detail the features of glacial Lake Agassiz 200 miles to the east in the Red River Valley. Field work in 1934 disclosed shore lines of stages of Lake Souris about 600 feet higher than had been described by Upham. The altitude of the highest shore line is 2140 feet above sea level. It is present on the northeast side of the late Wisconsin Altamont moraine, which occupies the divide between Missouri River and Hudson Bay drainage. Upham recognized a shore line at an altitude of about 1600 feet and other shore lines are present between the altitudes of 1900 and 2140 feet.

The shore lines of Lake Souris at altitudes of 1900 to 2140 feet above sea level trend diagonally across Ward County from northwest to southeast and extend into McHenry and McLean counties. The 2140-foot level of the lake drained through a spillway system in the vicinity of Russo and through Turtle Lake Creek, into the Missouri River; this channel is marked in part by Strawberry and Turtle Lakes.

The highest of a group of well developed shore lines at altitudes of 1560 to 1620 feet above sea level in eastern Ward and southern McHenry counties was drained by a spillway located in Ts. 148 and 149 N., Rs. 72 and 77 W., which entered the James River in the vicinity of Fessenden. This drainage line was later captured by the Sheyenne River flowing into Lake Agassiz. Successively lower stages of the lake represented by the lower shore lines were drained through spillways located progressively farther north and east until the present course of the Sheyenne River was established.

The 2140-foot level of Lake Souris could not have been dammed between a uniformly retreating ice front and the high divide occupied by the Altamont moraine because the altitude of the moraine decreases southeastward to less than 2000 feet in east-central Burleigh County, less than 60 miles from the shore lines studied.

The speaker suggests the following tentative interpretation of the origin of Lake Souris: The late Wisconsin glacier advanced southwestward with an even front to the present position of the Altamont moraine on the northeastern edge of the Missouri plateau. As the volume of ice in the glacier began to decrease the Turtle Mountains, in northeastern Bottineau and northwestern Rolette countries, with an altitude of 2000 feet or more, served as an effective barrier to the waning glacier and created a stagnant body of ice southwest of them; however, around the southeast side of the mountains the glacier still had sufficient volume to keep the ice in contact with the terminal moraine in Sheridan County and dam the water derived from the rapidly melting stagnant ice in Ward, McHenry, and parts of adjacent counties. There probably was a relief of more than 400 feet between the surface of active ice on the northwest side of the Turtle Mountains and the floor of the pre-Wisconsin valley in the region of ice southwest of the mountains. A lobe of ice probably extended southeastward along the valley now occupied by Souris River to the vicinity of Drake; the direction of movement in this lobe was nearly normal to the regional direction of ice

movement. Two straight, symmetrical steep-sided ridges, 15 to 25 feet high trending about N. 36° W., which are more or less continuous for about 10 miles in the vicinity of Drake and Balfour have been interpreted as beaches by Upham and as eskers by Campbell; they probably are alined features resulting from ice movement and indicating the direction of movement but they may have been modified by later wave action of Lake Souris. The northwest trend of other surface features in the vicinity of Drake and Balfour also suggests that a lobe of ice in the pre-glacial valley moved in a direction approximately at right angles to the direction of regional ice movement. (*Author's abstract.*) Discussed by Messrs. ALDEN, HESS, MATTHES, LEGGETTE.

A. A. BAKER: *Geologic structure of southeastern Utah.* Southeastern Utah, lying within the Colorado Plateau, is characterized by several types of structural features, including huge asymmetrical upwarps, domes associated with laccolithic intrusions, the southern edge of the Uinta Basin structural depression, a north-trending zone of normal faults at the west edge of the Plateau, and a group of numerous folds, faults, and faulted folds that are found in a limited area near Moab. Folding has occurred in the region several times since the end of the Mississippian, but the principal deformation that is reflected in the structure of the surface rocks took place at the end of the Cretaceous or early in the Tertiary and was therefore related to the Laramie orogeny. The large domical uplifts have a northerly trend and are strongly asymmetric with the steep limb toward the east; they were formed at the end of the Cretaceous, possibly as a reflection in the surface rocks of more or less vertical uplifting along deep-seated reverse faults. The group of numerous smaller folds, faults, and faulted anticlines in the part of the region near Moab also is believed to have been formed near the end of the Cretaceous; their formation is obviously related to the presence of the plastic saliferous beds of the Pennsylvanian Paradox formation beneath the surface rocks, because the structural features of this type near Moab are typically developed only within the area underlain by the Paradox formation and because the saliferous beds have been intruded into the overlying rocks at the crests of some of the folds. Events in the Tertiary structural history of the region include the intrusion of igneous rocks in four isolated mountain groups, the downwarping of the Uinta Basin, and the development of the zone of normal faults at the west edge of the Plateau; it is not possible to determine the order of these events nor to determine whether they represent different modes of expression of one period of crustal disturbance. (*Author's abstract.*) Discussed by Messrs. HESS and SCHALLER.

528TH MEETING

The 528th meeting was held in the Assembly Hall of the Cosmos Club, April 10, 1935, President SCHALLER presiding.

Program.—C. F. PARK, JR., and R. A. WILSON: *The Battle Branch gold mine, Auraria, Georgia.* The Battle Branch gold mine is in the southwestern part of Lumpkin County, Georgia, about 60 miles north of Atlanta. Gold was discovered here in 1831, and the property has been worked at irregular intervals since that time. The mine was reopened in January, 1934, and has since produced about $20,000.

The ore deposit is of the lode type and consists of many stringers and lenses in the Carolina gneiss, generally parallel to the planes of schistosity, which trend about N. 30° E. The Carolina gneiss is a finegrained quartz-

muscovite-biotite schist, which locally contains considerable discoidal garnet. The foliation planes of the gneiss strike a few degrees east of north and dip 20°–45° E. Two other systems of fractures are present. One strikes approximately parallel to the lode and dips 50°–70° NW; the other strikes northwest and dips steeply either northeast or southwest.

The mine is opened by a shaft sunk 185 feet on the incline, or about 110 feet vertically below the bottom of an old hydraulic pit. Two levels have been driven from the shaft, at 85 and 185 feet on the incline. The saprolite and weathered rocks extend to about the 85-foot level; below this the rock appears fresh and unaltered. Three zones or bands of quartz are recognized in the underground workings. These zones range in width from a few inches to a few feet; they are generally separated by 3 to 10 feet of gneiss. In a few places two of the bands merge and form pockets of quartz of considerable size.

The gold is coarse; the largest nugget reported weighed about 14 pennyweight. The gold occurs in pockets and shoots of varying dimensions. The width on the strike is usually less than 10 feet, and the thickness is less than 2 or 3 feet. The length is the most variable dimension and ranges from about 10 feet to more than 100 feet. The largest pocket reported yielded about 9,000 pennyweights.

The foliation planes in the schist form gentle sweeping curves, both on the strike and on the dip. Narrow quartzite bands are present locally in the schist, and these bands tend to become thicker near the crests of the rolls. The northwestward-striking fractures are also better developed near the crests of the rolls. The ores are localized where the northwesterly striking fractures intersect the lode, and an especially favorable place to look for ore is where these intersections cut the northwestward-dipping fractures. The ore shoots are commonly limited by bands of coarse red garnet. A little post-ore movement is shown by smeared gold and sulphides and brecciation of the quartz. This movement was small, and offsets of more than about 3 feet have not been seen. No evidence of post-ore movement was seen on the lode.

The gangue minerals include quartz, garnet, kyanite, muscovite, biotite, chromium mica, chlorite, chlor-apatite, and small amounts of tourmaline. Three types of garnet are distinguished—(1) discoidal almandite garnet in the gneiss, (2) red almandite garnet bordering the ore shoots, and (3) a black garnet, mostly almandite, with a little spessartite, found in the gneiss immediately next to the quartz but rarely in the quartz. Both the almandite in the lode and the black garnet are coarsely crystalline. Kyanite is present in several places, and one gold shoot changed in depth to a tube of kyanite less than 2 feet in diameter.

The ore minerals include both yellow and red gold, galena, pyrrhotite, chalcopyrite, fine-grained pyrite, magnetite, and ilmenite. The red color of the gold is caused by thin layers of red iron oxide. Small amounts of marcasite occur in seams. This mineral is probably of supergene origin. Pyromorphite is a common constituent in the saprolite ores. The silicate minerals, especially garnet, kyanite, and the micas, are coarse in and near the lode. They become progressively finer away from the lode. The silicate and ore minerals are thought to have been deposited (or the silicates possibly recrystallized) by the same fluids which, during the stages of sulphide deposition, were at considerably reduced temperatures and pressures. Gold and galena generally occur together and are considered to be approximately contemporaneous. The ores are thought to be hypogene. (*Authors' abstract.*) Discussed by Messrs. MERTIE, FERGUSON, SCHALLER, NOLAN.

W. W. RUBEY: *The force required to move particles on a stream bed.* Geologists are familiar with the venerable Leslie-Hopkins law of current impact, which is that the diameter of the largest particle a current can move is proportional to the square of the velocity. But hydraulic engineers have found this deductive law of little practical use because it refers strictly to velocities very near a stream bed and such "bed" velocities are difficult if not impossible to measure. Instead, many engineers prefer to use the alternative DuBuat-DuBoys law of current drag or critical tractive force, which states that the diameter of largest particles moved varies as the product, stream depth by stream slope. This law, like its rival, rests on a deductive basis and it even has age priority but, above all, it has been found useful in estimating the sizes of particles moved by actual streams.

Upon submitting these two "laws" to the test of G. K. Gilbert's laboratory observations on carefully sized sands and gravels, it becomes evident that neither fits the facts completely. When the mean velocities of current are low, high values of the product, depth times slope, are needed to start movement of some particular grain size; but at high velocities, movement of the same grains starts when the depth-slope product is much lower. Clearly, the data fit better to some sort of compromise between the two classical theories than to either of them taken singly.

In this paper, an attempt is made to set up a physical background for such a compromise theory by (a) accepting the Leslie-Hopkins law of the relation between maximum particle diameters and "bed" velocities for a given particle-shape and roughness of bed, (b) calculating this "bed" velocity from mean velocity, hydraulic mean depth, stream slope, and the coefficient of frictional resistance of water, and (c) estimating this coefficient of resistance from a ratio of channel roughness, analogous to the one used by Nikuradse and Prandtl for rough pipes. The resulting formula, which appears to fit experimental data satisfactorily, indicates that, for a given degree of channel roughness, the diameter of largest particles moved is proportional to the product, mean velocity X (hydraulic mean depth X slope)$^{1/2}$.

Properly and sufficiently qualified, this compromise theory seems to be applicable also to large-scale natural streams, and it therefore may be useful as a basis for estimating some of the flood characteristics of the streams that have laid down ancient sediments. The more important of these essential qualifications are: (1) The formula does not apply to the movement of clay, silt, and fine sand because the viscous drag of water flowing past such small particles far outweighs the effect of current impact. (2) The formula applies only to streams in turbulent flow and not to thin sheets in viscous or laminar flow. (3) For slopes steeper than about 5°, further refinements of the theory are required. (4) Stream "erratics" (abnormally large boulders or pebbles that occur in minor quantities in many stream deposits) probably have reached their sites of deposition by rafting, caving from cut banks, dumping from steep tributaries, slow creeping on the stream bed, etc.—processes entirely different from those by which the bulk of the material is moved; and the theory thus does not apply to the diameters of these coarse "erratics."

As examples of the possible uses of the compromise theory, estimates were offered of (a) the maximum size of pebbles moved freely by the present Mississippi River, (b) the relative size of the Mississippi when it built certain Pleistocene gravel terraces, and (c) the general nature of the streams that deposited the Wasatch conglomerate in western Wyoming. (*Author's ab-*

stract.) Discussed by Messrs. HESS, MERTIE, MATTHES, CALLAGHAN, LEGGETTE, CAPPS, CADY, SCHALLER.

F. E. MATTHES: *Origin and age of the eastern escarpment of the Sierra Nevada.*

529TH MEETING

The 529th meeting was held in the Assembly Hall of the Cosmos Club, April 24, 1935, President SCHALLER presiding.

Program.—R. A. DALY: *The strength of the earth.* The address dealt specifically with the distribution of strength in the earth at the present time. According to the speaker's preferred "model" of the earth, notable strength is confined to a true, crystalline crust, nowhere exceeding about 80 kilometers in thickness. The thick underlying silicate shell is thought to be elastico-viscous and to have vanishingly small strength. Objections to, and arguments for this theoretical picture of the earth's interior were discussed. The substance of the address is printed in this JOURNAL 25: 389–399. (*Author's abstract.*) Discussed by Messrs. KEITH, WRIGHT, ADAMS.

530TH MEETING

The 530th meeting was held in the Assembly Hall of the Cosmos Club, May 8, 1935, President SCHALLER presiding.

Informal communications.—C. P. Ross discussed the occurrence of a group of rare mercury chlorides in the mercury lodes of the Terlingua district, Brewster County, Texas, and other regions. These were studied some years ago by Hillebrand and Schaller, who noted incidentally that tests show the pink altered rock associated with the ore contains calomel. Tests made by J. J. Fahey show that calomel or a similar mercury chloride is present in most specimens of altered rock and cinnabar ore not only from the localities where mercury chlorides had hitherto been recognized but from widely scattered lodes of different characteristics throughout the region. Although so finely disseminated that no hint of its presence is afforded by visual inspection the quantity in most specimens tested is sufficient to be of commercial significance. More accurate data will be available when chemical work now in progress is completed.

Specimens of cinnabar ore in the U. S. National Museum from Alaska, Arizona, Arkansas, California and Nevada were tested by Fahey and found to contain calomel or a related mercury mineral. As there is reason to think that kleinite, one of the group of chloride minerals crystallized at a temperature above 130°C. and as the mercury in certain minerals of the group is in the mercurous state, it appears that these chloride minerals are of hypogene origin. These facts indicate that calomel and related minerals in significant amounts are of much more widespread occurrence than has hitherto been supposed. Their presence can be detected only by suitable chemical tests. As calomel does not yield metallic mercury by simple heating in air it seems possible that some of the mercury present in this form in ore may escape recovery in commercial reduction plants.

F. E. MATTHES exhibited some unusual wind-faceted pebbles and discussed their mode of origin. Discussed by Messrs. MISER, BRADLEY, GOLDMAN, R. C. WELLS.

Program.—W. G. PIERCE: *Some significant features of the Mississippian-Pennsylvanian contact in the Tri-State district.* In the summer of 1934 the United States Geological Survey made an investigation of the southeastern Kansas coal field. While mapping the Cherokee shale, of Pennsylvanian age,

which contains the principal coal beds of the field, the speaker also obtained data on the stratigraphy of the lower part of the formation and its relation to the underlying Mississippian limestone.

Some of the earlier work on the lead and zinc deposits had predicated a karst topography on the Mississippian surface upon which the Cherokee shale was deposited. This idea, however, does not appear to be supported by the stratigraphy, structure, and sink holes observed in that part of Cherokee County, Kansas, northwest of Spring River. A structure map of the base of the Cherokee shale compiled from drill hole data supplemented by surface observations shows two directions of structural trends in that part of the Tri-State lead and zinc district lying in southeastern Kansas. One trend is N. 35° E. and the other N. 40° W. An outstanding feature is a continuation of the Miami trough, which enters Kansas at Treece and extends northeastward beyond Lawton. There are also indications of smaller depression trends on both sides of the Miami trough and parallel to it. The two most prominent northwest trending structures intersect the Miami trough at Treece and Lawton. There is also the suggestion of a northwest trending structure about 2 miles north of Baxter Springs. The question of whether the structure indicated by contours drawn on the base of the Cherokee shale is due to pre-Cherokee erosion and deformation, or is due to post-Cherokee deformation is considered from the viewpoint of stratigraphic and physical data, which may be summarized as follows: With one exception, the basal 30 feet of the Cherokee is a uniform series of beds throughout the area covered, consisting of about 15 feet of dark shale at the base, overlain by a thin coal bed and above this 15 to 20 feet of sandstone which, in northeastern Oklahoma, is called the Little Cabin sandstone member. At the one place this stratigraphic section did not prevail, the relationship that exists can reasonably be interpreted as one of nondeposition of the basal Cherokee beds upon an area of slight relief in the Mississippian surface.

Nine recent sink holes are known in the area and in several of them the walls of ancient or fossil sink holes can be seen. In the fossil sinks, the Cherokee shale has been deformed after it was deposited. The material which fills the fossil sinks was obviously deposited on horizontal surfaces rather than in depressions, for, so far as can be observed, the strata in the lower part of the fossil sinks are identical with the adjacent undisturbed Cherokee section. So far as observed, the basal Cherokee does not contain any conglomerate and the top of the Mississippian does not have a chert rubble. Cross sections compiled from logs of holes drilled at intervals of 400 feet show that across such depressions as the Miami trough the Cherokee shale has been deformed with and practically to the same degree as the contact between the Cherokee shale and the Mississippian limestone. The irregularities in the Pennsylvanian-Mississippian contact in that part of Cherokee County, Kansas, studied are therefore thought to be due principally to deformation and solution that took place in post-Cherokee time. This interpretation, however, is not extended to the Tri-State district as a whole but is applied only to that part lying in Kansas. (*Author's abstract.*) Discussed by Messrs. C. S. Ross, WILLIAMS, SEARS.

G. F. LOUGHLIN: *Relation of structure to surface features in the Pikes Peak quadrangle, Colorado.* A study of folds in the Pikes Peak folio, expressed by remnants of sedimentary rock, shows that the larger irregularities in the present floor of pre-Cambrian granite conform to anticlines and synclines. The folds, formed during the Laramie revolution, range in trend from southeast in the southwest part of the quadrangle to northeast in the southeast

part and north in the adjoining Colorado Springs quadrangle. They are concentrically arranged around a central dome that includes Pikes Peak and the Cripple Creek mining district. This dome, though elevated during the folding and later movements, may have existed to some degree since pre-Cambrian time, and may never have been so thickly covered by sedimentary rocks as the surrounding region. During folding the south-central part of the quadrangle was squeezed between forces from the southwest and southeast and became a rather complex, south-pitching syncline composed largely of easily eroded Mesozoic and Carboniferous rocks. The compressive force from the southeast was strong enough to produce at least one overthrust, and may also have produced tear faults along the east edge of the south-central syncline. North of the syncline the force from the southeast produced another overthrust that passes northward into a monoclinal flexure with westerly dip, which extends along the central part of the quadrangle east of Oil Creek. These structural features must be considered in any attempts to reconstruct erosion surfaces.

The first two stages of post-Laramie erosion are represented by the summit and shoulders of Pikes Peak and by the higher mountains in the Cripple Creek district. In view of the regional structure, these two stages may have removed sedimentary rock without eroding a very great amount of granite. The third stage exposed the granite floor almost as extensively as it appears today. Volcanic activity followed, covering the undulating granite floor in the western half of the quadrangle, and was accompanied by deposition of the Florissant lake beds and water-laid tuffs in a shallow syncline. The fourth stage involved partial removal of the volcanic rocks and continued erosion of the high granite slopes. It was accompanied by the deposition of gravels or "grits" on synclinal floors and shallow valleys. Eruption of the Cripple Creek volcano followed and its erosion took place in 2 general stages, controlled by outlying masses of resistant phonolite, again exposing the granite floor. Faulting then dislocated the granite floor, especially along the central monocline, and caused subsidence of the south-central synclinal block. Subsequent stages of erosion lowered the valley of Oil Creek in this synclinal block and developed broad pediments in the dominant volcanic area to the west of Oil Creek; but in the higher eastern part where resistant granite dominated, it was confined to canyon cutting mainly along fault zones. In spite of these many stages of erosion, the undulating character of the granite floor is preserved, though it has been repeatedly exposed. (*Author's abstract.*) Discussed by Messrs. BRADLEY, RUBEY, SHENON.

WALLACE LEE: *Channeling in the Cisco group, Young County, Texas.* Discussed by Messrs. HENBEST, KING.

W. D. JOHNSTON, JR., and G. TUNELL, *Secretaries*

SCIENTIFIC NOTES AND NEWS

Prepared by Science Service

NOTES

National Park Service.—Under the direction of Acting Chief Naturalist COOPER a premiere showing of talking motion pictures in geology was given in the Connecting Wing Auditorium, Constitution Avenue, on the evening of October 30. Titles of the films were Atmospheric Gradation, Work of Rivers, Underground Water, Mountain Building, Geological Work of Ice, and Volcanoes. These films illustrate scenes from the national parks and typify the new educational device for the teaching of science. They are designed for use in the C.C.C. camps and schools.

GEORGE M. WRIGHT, Chief of the Wildlife Division, attended the annual meeting of the American Ornithologists' Union in Toronto, October 21–24. Following this, he attended the 31st Annual Convention of the National Association of Audubon Societies in New York City. Director CAMMERER, Assistant Director BRYANT, GEORGE F. BAGGLEY of the State Park Wildlife Division and BEN H. THOMPSON, Special Assistant to the Director, attended the Audubon Societies' meeting. Mr. WRIGHT gave a talk entitled *Bootstraps of wildlife conservation* at this meeting.

WILLIS KING of the Wildlife Division presented a paper before the members of the Biological Society of Washington on the evening of November 2 regarding ecological studies of reptiles and amphibians in the Great Smoky Mountains National Park.

American Wildlife Conference.—A National meeting of all organizations interested in the conservation and restoration of game birds and animals will be held in Washington, February 3 to 7, 1936, under the auspices of the recently organized American Wildlife Institute. A planning committee is now functioning, and preliminary arrangements are rapidly taking definite form. The following organizations are represented on this committee: Bureau of Biological Survey, National Park Service, Forest Service, Bureau of Fisheries, Soil Conservation Service, Office of Indian Affairs, American Association for the Advancement of Science, American Wildlife Institute, Izaak Walton League of America, American Ornithologists' Union, National Association of Audubon Societies, Society of American Foresters, American Forestry Association, National Grange, National Rifle Association, Science Service.

National Bureau of Standards.—WILLIAM D. APPEL, chief of the textile section, discussed the standardization of textile test methods with members of Committee D-13 on textiles of the American Society for Testing Materials at the meeting of the committee in New York on October 16, 17, and 18 and with members of the Research Committee, American Association of Textile Chemists and Colorists in Boston on November 1. He addressed the New York Section of the Association on October 25 on consumer standards for textiles.

The work on the chemistry of wool being carried out in the textile section of the National Bureau of Standards with the cooperation of the American Association of Textile Chemists and Colorists received additional support during the summer through the appointment of Dr. J. A. CROWDER and Mr. ARTHUR L. SMITH to assist Dr. MILTON HARRIS with the work. Messrs.

APPEL, CROWDER, SMITH, and HARRIS reported on the progress of the work at a meeting of the advisory committee in Philadelphia on October 24.

During the past summer WILLIAM F. MEGGERS, chief of the spectroscopy section of the National Bureau of Standards, attended the Fifth General Assembly of the International Astronomical Union in Paris, and visited various scientific laboratories to determine the present status of spectroscopic research in Europe. Doctor Meggers is President of Commission 14 of the Union, on Standard Wave Lengths and Solar Spectrum Tables.

Pan-American wilderness areas.—A recommendation to establish reserves of primeval areas in the different countries of the Americas from the Arctic to the Antarctic was made before the Washington meeting of the Pan-American Institute of Geography and History by Dr. JOHN C. MERRIAM, president of the Carnegie Institution of Washington. Agreeing with Dr. Merriam's proposal, the Institute passed a resolution to recommend the matter to governments of Pan-American countries for careful consideration. The areas, Dr. Merriam said, should be so chosen as to be scientifically useful to all the countries of America, and, in fact, to the entire world. They should be maintained, he urged, in precisely their natural condition. It would not matter if they should be somewhat hard to reach by travel. For when wilderness areas are used as very popular parks they may get considerable wear and tear. Moreover, artificial park changes, such as roads, firelines, or ditches, may alter original values of the region for scientific study. At least, time and money spent on making the reserved areas accessible should be matched by expenditure to secure knowledge of the areas.

Safer landings.—Safer airplane landings are expected to result from a new instrument, developed by the National Advisory Committee for Aeronautics here, which makes possible, for the first time, an accurate plotting of the "blind spots" in a pilot's line of vision. Blind spots are those regions where the body, engine or wings of an airplane obstruct the view so that the pilot must make his landings, in part, by instinctive "feel" of his plane rather than by actual sight. Blind spots, too, are the menace of military airplanes in wartime, for an enemy aviator can approach in a blind spot zone and attack almost before the victim plane realizes anyone is near.

The new apparatus, which charts blind spots is the invention of MELVIN N. GOUGH of the N. A. C. A. staff at Langley Field, Va. It is called the visiometer. Placed in the cockpit of a plane at the spot where the pilot's head comes in actual flight, the device measures accurately the exact parts of the plane which obstruct vision. Plotting the data thus obtained on graph paper, scientists obtain a plane projection of the three-dimensional field of view. The result is analogous to the Mercator projection of the three-dimensional earth on a wall map.

U. S. National Museum.—Several notable collections in paleontology were made in the West during the past digging season, by Curator C. W. GILMORE. From the Big Horn Basin in Wyoming have come the bones of a *Coryphodon*, popularly known as an "elephant-bear," an animal of the early Tertiary. Early Cretaceous formations yielded a large number of saurian fossils, notably what appears to be a fairly complete skeleton of one of the "bird-footed" dinosaurs. A *Pteranodon* wing-bone has been sent to the Museum by TOM H. WELLS, of Austin, Texas. This genus has not previously been reported south of western Kansas.

The National Museum's collection of the Paleocene fauna from the Crazy Mountain region in Montana, obtained by the late Dr. JAMES W. GIDLEY, has been worked over by Dr. GEORGE GAYLORD SIMPSON of the American Museum of Natural History, completing examinations left unfinished by Dr. Gidley. Some sixty species have been identified.

Bureau of Fisheries.—An agreement for cooperative research has been worked out with the Musher Foundation, Inc., of New York City, to study methods of preventing rancidity in stored fatty fish. W. J. HART, a graduate student at the University of Maryland, has been employed by the Foundation as a research associate, to work in the Bureau's technological laboratories at College Park, Md.

A specimen of a nautiloid cephalopod, of Devonian age, was discovered recently, embedded in the black marble baseboard of a corridor in the Bureau's section of the Department of Commerce building. It was first noticed by E. W. BAILEY, assistant chief of the division of scientific inquiry. Identification was made by Drs. A. F. FOERSTE and PAUL BARTSCH of the National Museum.

Biological Survey.—Resignation of J. N. DARLING, chief of the Bureau since March, 1934, took place on November 15.

Decisions in several Federal courts recently have been unanimous in sustaining Federal regulations governing the shooting of migratory game birds, against legal attacks made on their validity. These decisions were handed down in courts at Savannah, Ga., Lexington, Ky., and Springfield, Ill.

ARTHUR C. ELMER was appointed chief of the migratory waterfowl division on September 3.

The recent retirement of EDWARD A. PREBLE, after forty-three years of service with the Survey, was marked by a testimonial meeting of members and retired members, where Mr. Preble was presented with a testimonial brochure and a gift consisting of the complete works of Thoreau, Burroughs and Muir.

VERNON BAILEY, former chief field naturalist of the Survey, retired in 1934, has been appointed as a collaborator to assist in certain field surveys where his exceptional knowledge of wildlife, and of its food and cover requirements, are especially helpful.

A dense stand of giant cut-grass (*Zizaniopsis miliacea*) was discovered at Dogue Creek on the Potomac, just south of Mount Vernon, during the past summer, by F. M. UHLER. Since this plant is a serious menace to duck feeding grounds, the stand was immediately destroyed. Removal of a long-established pest, the water caltrop, is progressing satisfactorily, with the assistance of a corps of C.C.C. workers.

U. S. Geological Survey.— Dr. T. W. STANTON, Chief Geologist of the U. S. Geological Survey, has retired after continuous service on the Survey since 1889. For thirty years, Dr. Stanton had charge of the Survey's Section of Paleontology and Stratigraphy. Although well past the ordinary retiring age, Dr. Stanton had been continued at his post through special Presidential exemption. He was retired at his own request, and is succeeded by Dr. G. F. LOUGHLIN.

D. F. HEWETT has been appointed Geologist in Charge, Section of Metalliferous Deposits, to succeed G. F. LOUGHLIN, who is now Chief

Geologist. Mr. Hewett is the Survey's specialist on manganese and has given much attention to the discovery and development of deposits of this important mineral in this country. He has recently made special studies of the Warm Springs district in Georgia and of the mineral resources of the Boulder Dam region.

The practically clear Colorado River water which had been coming down from Boulder Reservoir during July and August 1935, suddenly became turbid September 3, and from September 3 to 14 carried about 2,000,000 tons of silt past the Willow Beach gaging station 10 miles below Boulder Dam. The regular examinations being made by the Geological Survey of the suspended and dissolved material in the river water at the Grand Canyon and Willow Beach gaging stations show that the water carrying this silt had flowed through and under the 4,500,000 acre feet of water in the reservoir without enough mixing or detention to permit deposition of the silt in the reservoir.

Suggestions to authors of papers submitted for publication by the United States Geological Survey, with directions to typists is the title of Editor B. H. LANE'S revised and enlarged fourth edition of G. M. Wood's pamphlet published in 1916. Because of the clarity and proved worth of its general suggestions, this publication, although intended particularly for Geological Survey contributors, should also be found useful to writers in other fields.

Bulletin 862 on *The southern Alaska Range* by S. R. CAPPS, was published recently. The report describes an area of more than 23,000 square miles, largely unexplored until 1926. Although many patches within this great mountain area remain unsurveyed, its principal topographic and geologic features are now known. This part of the range reaches heights of 10,000 to 12,000 feet and includes a labyrinth of ragged crests that nourish large valley glaciers, interspersed with timbered valleys whose beauty is further enhanced by the presence of magnificent glacial lakes. Here moose, caribou, bighorn sheep, and grizzly bears live in a primitive wilderness almost undisturbed by man. One of the highest peaks of the region is Mount Spurr, a volcano that still shows signs of mild activity; and other volcanoes lie to the eastward. They are the northern members of the long line of volcanic vents that stretches through the Alaska Peninsula and the Aleutian Islands. The geologic history of the region has been complex, the rock formations ranging in age from ancient gneiss, schist, and crystalline limestone to the present stream, lake, and beach deposits. Intrusive masses of granitic rocks, both large and small, cut the southern Alaska Range, and it is likely that careful prospecting near the contacts of sediments with these intrusives will result in the discovery of lode deposits of gold, silver, copper, lead, and zinc.

Flathead Tribal Constitution.—The signing of the first of the projected Indian tribal constitutions, in the office of Secretary of the Interior ICKES, is regarded as a historic step in the relations between the Federal Government and the tribes. The first document of the kind to be ratified was the Constitution of the Flathead Indians. Prepared mainly by the tribe itself and accepted by popular vote five to one, it gives the Flathead Indians the legal machinery for organizing their own group and taking over a large measure of power over their own affairs. All Indian tribes who accept the provisions of the Indian Reorganization Act, passed by the last Congress, may work out their own constitutions, and a number of tribes have been actively engaged in this task.

The historic document was accepted by MARTIN CHARLO, 75-year-old Flathead chief, who replied in his native tongue to Secretary ICKES' words of welcome. As on other historic occasions between Indian chiefs and white men, an interpreter echoed each speech in the alternative tongue. Once adopted, a tribal corporation cannot be abolished by any Indian Commissioner or Secretary of Interior. Only by Act of Congress can such an organization of Indians be dissolved.

NEWS BRIEFS

Although approximately 540 miles away from the shock center of the November 1 earthquake in Canada, the tremors at Washington were sufficiently strong to affect scientific instruments not designed primarily for recording quakes. At the U. S. Coast and Geodetic Survey's magnetic station at Cheltenham, Md., near here, a magnetograph for measuring and recording the variations in the horizontal component of the earth's magnetic field clearly detected the earth shivers between 1:07 and 1:19 A.M., E.S.T.

The Third World Power Conference, to be held at Washington simultaneously with the Second Congress of the International Commission on Large Dams, has been announced by the State Department, for September 7 to 12, 1936. President ROOSEVELT has accepted the honorary presidency of the Congress. MORRIS L. COOKE, Administrator, Rural Electrification Administration, is chairman of the executive committee.

Forest fires have been much more numerous this fall than normal, but the total burned-over area has been very much less, the Forest Service announces. This is ascribed in part to the presence of thousands of C.C.C. workers in the forests, ready to go into action against fires before they assume major proportions.

Direct radio-telephone service between the United States and the Dominican Republic was opened on October 31.

The Association for the Study of Neoplastic Diseases held a dinner on September 6 in honor of Dr. JOSEPH C. BLOODGOOD, adjunct professor of surgery at the Johns Hopkins University School of Medicine and one of the founders and directors of the association, during its annual meeting in Washington, D.C. Dr. JOHN SHELTON HORSLEY, Richmond, Va., presided; Dr. CLARENCE C. LITTLE, managing director of the American Society for the Control of Cancer, was among the speakers.

The first lecture in the Smith-Reed-Russell Series for this year at the George Washington University School of Medicine was given before the student body, members of the faculty and invited guests on October 24. The guest speaker for the occasion was Surgeon General CHARLES R. REYNOLDS, Medical Corps, U. S. Army. The subject of his address was *The Medical Corps of the United States Army.*

PERSONAL ITEMS

Dr. CHI-TING KWEI, dean of Yale-in-China School of Science, Central China College, Wuchang, China, who is at present on sabbatical leave in the United States, is spending several months at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, engaged in research work in terrestrial magnetism and electricity.

Dr. HERBERT FRIEDMANN, curator of birds, U. S. National Museum, was elected to a vice-presidency in the American Ornithologists' Union at its fifty-third annual meeting in Toronto.

C. F. W. MUESEBECK, entomologist in the Bureau of Entomology, has succeeded Dr. HAROLD MORRISON as chief of the Division of Insect Identification.

Dr. I. T. HAIG, chief of the Division of Forest Management at the Northern Rocky Mountain Forest and Range Experiment Station at Missoula, Mont, has been appointed assistant chief of the Division of Silvics in Washington.

The appointment of ROBERT M. CHAPIN as chief of the Biochemic Division of the Bureau of Animal Industry has been announced by the U. S. Department of Agriculture. Since the death of Dr. MARION DORSET last July, Mr. Chapin has served as acting chief of this division.

Dr. WALTER H. LARRIMER, formerly with the Bureau of Entomology and Plant Quarantine, has joined the Forest Service as staff assistant in forest research.

Dr. JULIAN H. STEWARD, associate professor of anthropology at the University of Utah, was appointed on October 21 to the position of associate anthropologist in the Bureau of American Ethnology, Smithsonian Institution.

Dr. MAX VON LAUE, professor of theoretical physics at the University of Berlin, who has been lecturing at the Institute of Advanced Study at Princeton and at the Johns Hopkins University, gave a lecture on *Thermo-dynamic fluctuations* in the Library of the Department of Terrestrial Magnetism, on November 4, 1935.

Dr. MAURICE C. HALL, chief of the Zoological Division of the Bureau of Animal Industry, spoke before the Sigma Xi Club of Oregon State College on October 8 on *What is scientific research?*

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